MACHINERY

Volume 44 NEW YORK, SEPTEMBER, 1937 Number 1

Steel Tubing Made by Resistance Welding

Tubing Formed from Coiled Strip Steel is Welded by Revolving Electrodes and Cut to Desired Lengths in One Continuous Process

By CHARLES O. HERB

WELDED steel tubing has been in use for many years, but the methods by which it is made today differ considerably from the early processes. The use of welded steel tubing was greatly stimulated by the large-scale manufacture of bicycles, and the bicycle industry is still an important consumer of welded steel tubing. This type of tubing was later adopted extensively in the manufacture of household equipment, office appliances, agricultural implements, and other products in which lightness and strength are advantageous. When the automobile industry became a large user of welded steel tubing, its rigid demands for quality led to the improved manufacturing methods now in use.

In the tube-forming process, the flat stock is first fed through rolls which gradually shape it to the form of a circle. Then the butted edges are welded together to make a continuous tube wall. Electric resistance, electric arc, and oxy-acetylene welding processes are all used for this operation.

Tubes made by Steel and Tubes, Inc., Cleveland, Ohio, are welded by the Johnston electric resistance welding process. Strip stock is fed continuously from coils through forming rolls, under large disk type welding electrodes, and finally to a machine unit which cuts the finished tubing to required lengths. Details of this process are described in the following. At the Youngstown, Ohio, plant of the Republic Steel Corporation, of which Steel and Tubes, Inc., is a subsidiary, tubes up to 16 inches in diameter, with a wall thickness of 1/2 inch, are made by the same method.

The strip stock is received in coils from the steel mill and trimmed accurately to the width necessary for shaping to the required diameter. The trim-

ming is performed by running sheets of steel through a pair of circular shears. Each coil of stock bears a tag that shows the analysis of the steel, its hardness, gage thickness, and width. It is the practice to order all steel for the individual jobs.

Hot-rolled steel is invariably used in the manufacture of tubes for boilers and similar applications, whereas cold-rolled steel is generally used in making tubes for mechanical uses. All strip stock is stored in a space adjacent to the starting end of the tube-making machines.

Shaping the Tubes from Flat Strip Stock

A battery of tube-forming machines is shown in the heading illustration. The flat strip stock is fed into these machines at the left-hand end, as seen in Fig. 1. A device is provided for registering the amount of stock in linear feet that is fed into the machine. The stock first passes through a pair of driving rolls and then through a series of forming rolls that produce the tubular cross-section. As each coil of stock is used up, the end is welded to a new coil, so that the feed is continuous.

At the beginning of the operation, the bottom rolls are shaped as illustrated in Fig. 2, and the top rolls are just the opposite, as shown in Fig. 3. However, the final forming rolls are of the same contour, top and bottom. In passing through this series of rolls, the stock is curved gradually in the manner illustrated diagrammatically in Fig. 4 until a concentric tubular shape is obtained. When the tubing leaves these rolls, there is about 1/16 inch of space between the butting edges.

An important factor in rolling tubing concentrically without surface marks is to maintain a high polish on the hardened forming rolls. The forming rolls are assembled in housing blocks, which can be interchanged conveniently in the machines.

How the Tubing Wall is Welded

The butted tubing is now drawn through the welding section of the machine illustrated in Fig. 5, which consists essentially of an overhead transformer unit that supplies current to a pair of disks that serve as electrodes. These electrodes are made from copper alloy. Sometimes they are castings and sometimes forgings.

The entire welding unit is adjustable up and down on the posts of the machine, and the amount of current delivered to the electrodes, as well as the speed of operation, can be closely regulated. As the formed tubing approaches the welding unit, it is guided in line with the electrodes by a steel blade which enters into the space between the unwelded edges. When the tubing passes under the electrodes, current is automatically applied and it travels from one electrode to the other across the tubing, creating heat through the resistance offered to the flow of the current. At the moment that the current is applied, the side rolls *B*, Fig. 6, exert sufficient pressure to bring the heated edges together and form a welded joint. A second pair of rolls, similar to rolls *B*, support the welded tubing at the sides after it leaves the electrodes. Directly below the electrodes, the tubing is also supported by a pressure roll *A*. The electrodes revolve freely, being actuated solely by the tubing as it is drawn through the machine.

Fig. 1. In the Forming of Welded Steel Tubing, the Flat Strip Stock First Passes through Driving Rolls and then through Forming Rolls that Curve the Stock Gradually to a Round Cross-section

Fig. 2. View of Bottom Row of Forming Rolls, the Upper Roll Housings having been Removed at the Time This Photograph was Taken

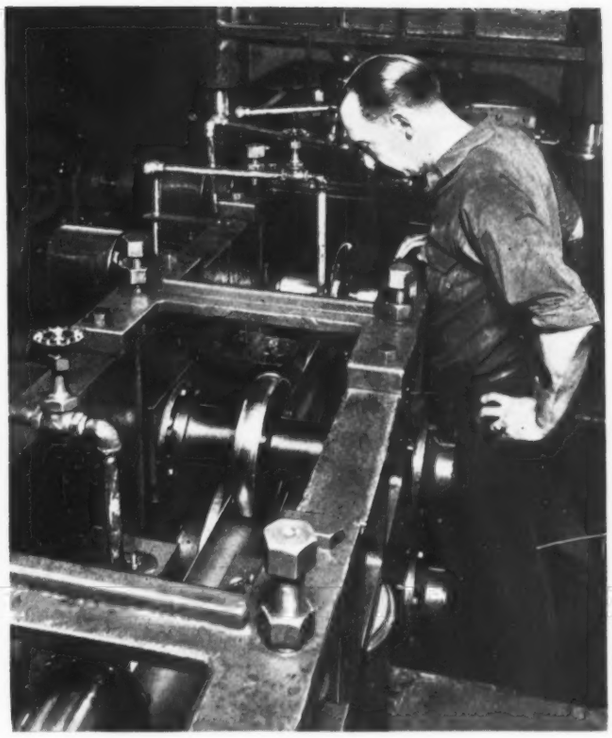


Fig. 3. The First Top Forming Rolls are Opposite in Contour to the Bottom Rolls, but the Final Pair of Rolls are of Similar Contour

The steel in the tubing manufactured by this process is not altered chemically, because the weld is made without the addition of molten metal. Since only the edges of the tubing are brought to the welding temperature, the heat is quickly dissipated with but slight grain growth.

Trimming off the Flash on the Inside and Outside of the Tubing

The excess metal or flash left on the inside and outside of the tubing by the welding operation is removed by several methods, although with tubing intended for certain applications, as in the manufacture of furniture, it is unnecessary to remove the inside flash. One of the methods consists of planing off the flash with tungsten-carbide tipped tools, shaped to the contour of the tubing. Two tool bits used for this purpose may be seen at the right-hand end of the transformer unit in Fig. 5. The flash is removed and a smooth finish obtained as the tubing passes beneath the cutters. It will be observed that small rolls support the tubing on the side at the point where the flash is shaved off.

Another method of eliminating the flash is to smooth it down while the tubing at the welded seam is still in the plastic state, by applying planishing rolls both inside and outside of the tubing, as shown in the right-hand view, Fig. 6.

After the flash has been cut off or rolled down, the tubing passes under several streams of cold water and between additional rolls that straighten and size it and insure its roundness. The tubing then reaches the rolls which pull it through the machine. However, on machines designed for handling the smaller sizes of tubing, there is a special pulling unit at this point which consists of a series of jaws attached to a constantly moving silent chain. The tubing now arrives at a "Turk-head," equipped with one pair of rolls on horizontal shafts and a second pair on vertical shafts, which bring the tubing to the final size within the specified tolerance. A stream of soluble oil is then directed on the tubing to prevent rusting during shipment and storage.

The tubing now reaches the automatic cut-off machine, illustrated in Fig. 7, which is controlled by an electric relay in such a manner that the machine remains in the position illustrated, with its shear blade raised, until the desired length of tubing has been fed through. Then the machine automatically moves with the tubing, and the shear blade is forced downward, cutting the tubing off to the specified length. The shear now rises again and the cut-off machine returns to its normal position, ready for cutting off the next length. The shear is raised and lowered by means of crank-arms on opposite sides of the machine. This arrangement of the cutting-off unit permits continuous operation of the entire tube-forming and

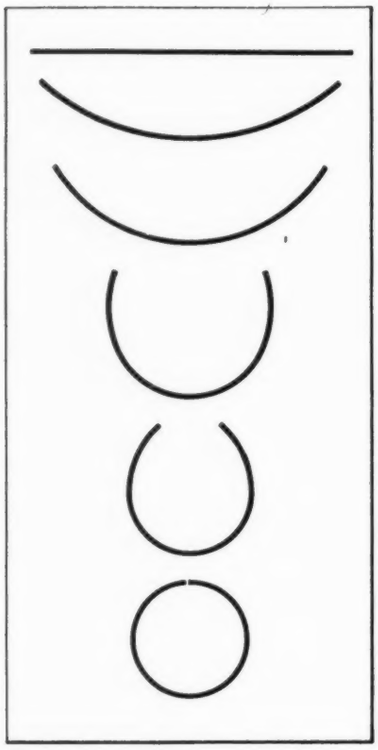


Fig. 4. Diagrams Illustrating the Successive Steps Taken in Transforming Flat Stock into Tubing

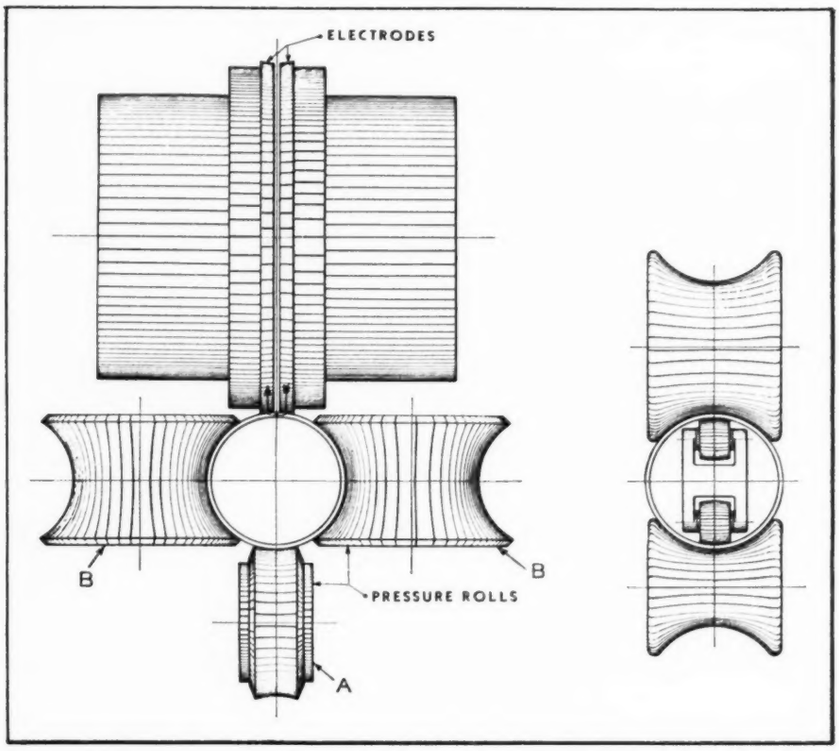


Fig. 6. Diagrams Illustrating the Application of Rolls on Both Sides and Beneath the Electrodes that Force the Heated Tube Edges together to Form a Weld. The View at the Right Shows the Method of Applying Planishing Rolls for Smoothing down the Weld Flash

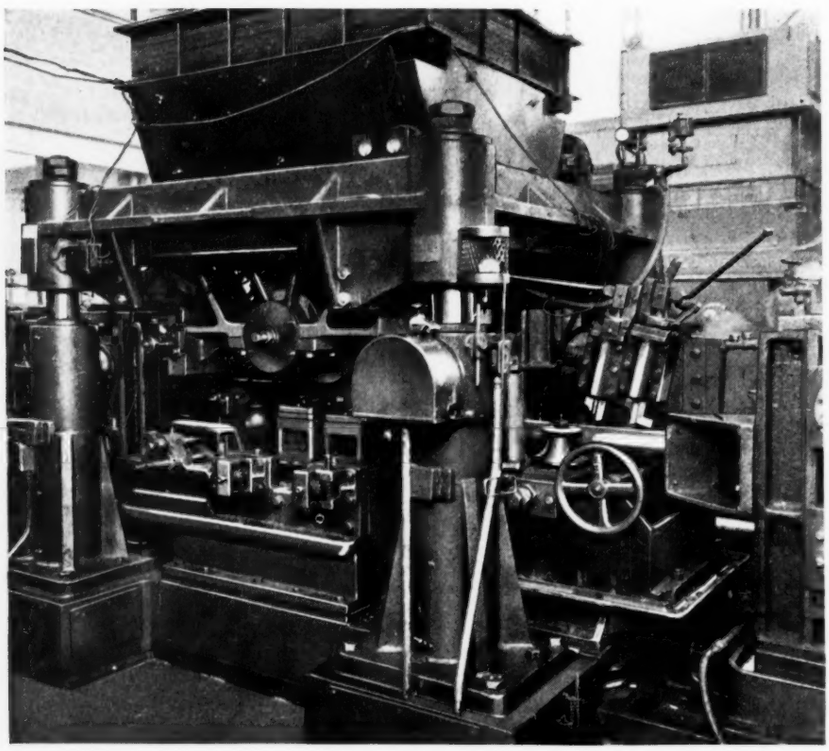


Fig. 5. The Welding Operation is Accomplished by Revolving Disk Type Electrodes which Receive Current from an Overhead Transformer Unit

welding machine. The cut-off tubes roll on a rack in front of the machine.

Various tests are performed to make certain that the tubing has the required physical properties. For instance, the specimen in the middle of Fig. 8 has been expanded outwardly at one end by means of rolls and flanged back, without the tube being torn or cracked at any point. The example at the left has been crushed endwise without fracture, while the specimen at the right has been flattened sidewise. Such tests are made each time that a machine is started, and if there are any indications of failure at the welded joint, no additional tubing is made until the condition that causes the defective product has been remedied.

Welded tubing of square, rectangular, oval, and special shapes is produced by rolling or by drawing round tubing through appropriate dies. All boiler tubing and other tubing for certain types of service are annealed in an electric furnace having a controlled atmosphere. The furnace proper is of the roller-hearth type, and is 36 feet long by 4 feet 4 inches across the rollers. At the far end of this furnace is a cooling chamber 78 feet long. The temperature of the furnace is approximately 1650 degrees F., which has been found to yield a steel of fine grain size that is both ductile and tough.

Tubes are bright-annealed when they leave this furnace unit. Boiler and pressure tubes, however, are carried by the roller conveyor to a gas-fired furnace that is maintained at a temperature of approximately 650 degrees F. Passage through this furnace imparts a thin blue oxide to the tubes, which reduces the chances of rust formation during shipment and storage.

Fig. 7. A Traversing Cutting-off Machine which Moves with the Welded Tubing and Cuts it to Required Lengths

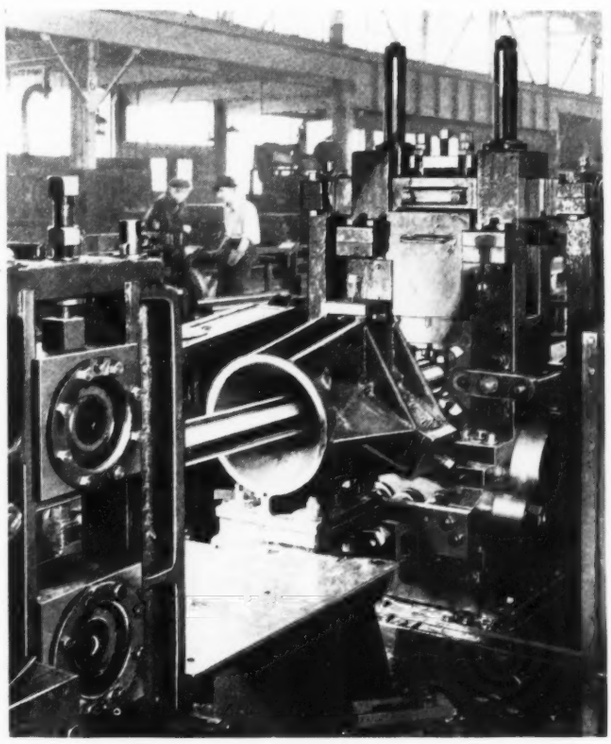


Fig. 8. Various Severe Tests are Performed on the Tubing at Each Machine to Guard against Defective Welds

* * *

The Lincoln Gold Medal of the American Welding Society

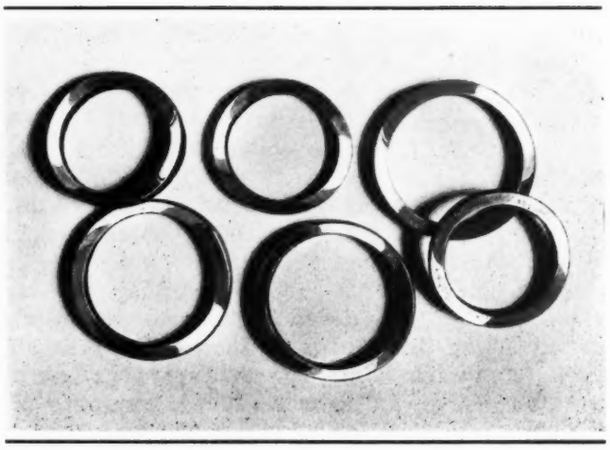
The design of the Lincoln gold medal offered by J. F. Lincoln, president of the Lincoln Electric Co., Cleveland, Ohio, to the American Welding Society, 33 W. 39th St., New York City, as a stimulus to the preparation of worthwhile contributions to the art of welding, has been approved, and work on the dies for the actual medal is now progressing. The medal will be presented to the author of the best paper on any phase of welding published in the Journal of the American Welding Society during the year November, 1936, to October, 1937. The medal, which is to be 2 1/2 inches in diameter, will be of solid gold. One side will bear the wording "Lincoln Gold Medal Award—American Welding Society." This inscription will surround a central figure symbolic of electric welding. In relief, on the reverse side, will be the name of the person winning the award, together with the date of presentation.

* * *

There are not enough things made in industry today to go around if the standard of living of the great mass of our population were raised to the level enjoyed by the most highly skilled labor crafts. Our first step must be to work out a plan to produce still more than in the past, and to see that the products thus manufactured reach a constantly broader strata of our population. That is the problem. It is not easy of solution; if it were, it would have been solved long ago.

Liquid Air Speeds Up Assembly

The Valve-Seat Inserts are Contracted by Passing them Through a Liquid-Air Refrigerator Having a Temperature of 312 Degrees F. Below Zero. They are Then Assembled Automatically in the Cylinder Blocks



By CHARLES O. HERB

REFRIGERATORS containing liquid air, in combination with machines of special design, make it possible to assemble heat-resisting alloy-steel valve-seat rings in the exhaust ports of Ford automobile cylinder blocks at a high speed. During a period of fifteen minutes or longer in the liquid-air refrigerator, which has the almost inconceivable temperature of 312 degrees F. below zero, the rings contract sufficiently to slide with ease into the eight recesses prepared for them in the cylinder blocks. The rings are held at the bottom of these recesses for five seconds by air-operated rams or plungers which also strike a hammer-blow of about forty pounds to insure that they are properly seated.

The rings are contracted 0.009 inch while in the refrigerator, so that they can readily be inserted in the recesses, which are 0.0045 inch smaller in diameter than the rings at room temperature. When the assembled rings expand upon their return to room temperature, they fit so tightly that there is no danger of their ever working loose.

At no time during the assembling operation are the cold valve-seat inserts touched by the operator. Each of the three machines employed for this operation assembles the eight valve-seat rings in cylinder blocks at the rate of 165 blocks an hour, giving a production of almost 4000 cylinder blocks in an eight-hour day for the three machines. Rings approximately 1 5/8 inches in diameter by 7/32 inch thick are assembled in the 85-horsepower engine blocks; and rings approximately 1 13/32 inches in diameter by 3/16 inch thick in the cylinder blocks for 60-horsepower engines.

One of the assembling machines is illustrated in Fig. 1; here the liquid-air refrigerator is seen mounted on top of the machine. Copper tracks or chutes lead from a narrow slot at the bottom of the refrigerator to the lower ends of the pneumatic assembling plungers, which are arranged on oppo-

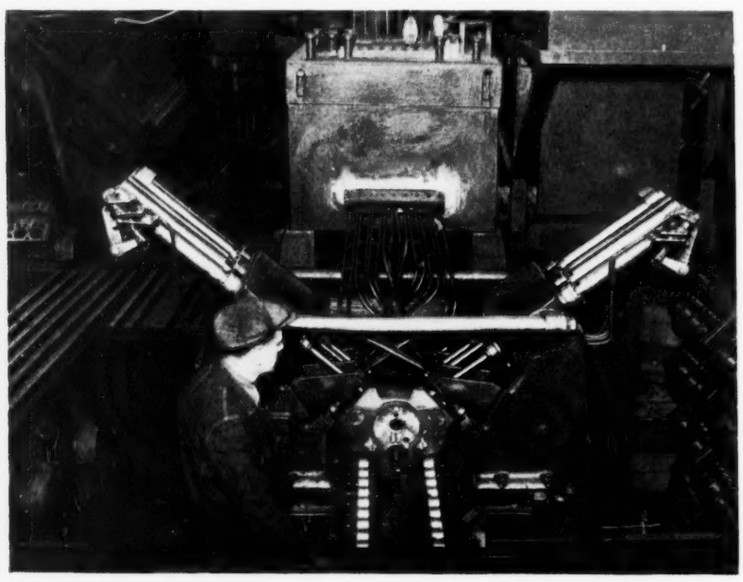


Fig. 1. Equipment that Assembles Eight Valve-seat Inserts Tightly in Cylinder Blocks at the Rate of 165 Blocks an Hour

# of Ford Valve-Seat Inserts

site sides of the machine. Each time that the operator pushes a cylinder block into the position shown, he depresses an electric button to actuate a hydraulic slide that operates back and forth in the slot in the refrigerator. This slide discharges eight valve-seat rings into the copper chutes ready for assembly in the exhaust port recesses of the cylinder block.

The rings are momentarily held by fingers at the lower end of the chutes until the advancing pneumatic plungers cause the fingers to release them and permit them to be pushed into the cylinder block. The valve-seat inserts are then held under pressure in the recesses while a spring at the upper end of each plunger is released and a hammer-blow struck to insure close contact between each ring and the recess shoulder. When the operation is completed, it must be impossible to slip a 0.0015-inch feeler gage between these two surfaces.

In loading the cylinder blocks into the fixture, they are slid over a hinged stop in the middle of the table, which is depressed by the block. This stop springs upward as soon as the cylinder block has been pushed past it, and the block is then pulled back against the stop for locating purposes. The cylinder block is located sidewise by rollers on both sides of the machine which come in contact with the bank sides of the block. At the end of the operation, the block is pushed through the machine to a conveyor line which carries it to subsequent operations.

The refrigerator is completely covered on the outside with steel sheets, which are welded along all edges. The inside, as may be seen from Fig. 3, consists of sheet steel, wood, and cast iron. All metal parts are made of non-rusting materials. Fullers' earth is generously used for insulating purposes in the cored compartments of the castings that make up the frame, in space *A* that surrounds the steel tank *B* containing the liquid air, and in the hinged lid *C* which covers the opening through which the liquid air is replenished.

The tank holds seven gallons of liquid air. Two to three gallons are supplied about every twenty minutes. The speed of the assembling operation and the fact that the liquid air is produced by the Ford Motor Co. make the operation an economical one. A cork with a wire that extends to the top of the refrigerator floats on top of the liquid air and indicates the level of the air in the tank. Tank *B* is made of 1/4-inch boiler plate (straight carbon steel).

The valve-seat inserts do not come into direct contact with the liquid air, as they are loaded into eight tubes *D* which extend downward through tank *B*. The inserts are first slipped over a bar that is drilled for its full length. A rod with fingers is slipped through the hole and the fingers expanded to prevent the loaded inserts from slipping off when the bar is entered into one of the refrigerator tubes *D*. Then the rod fingers are contracted, so that the bar and rod can be withdrawn. Cap *E* is next placed on top of the tube for sealing purposes.

In the center of this cap, there is a rod *F* which has a weight at the lower end that rests on top of the stack of inserts. Thus, the ball end at the top of rod *F* is lowered gradually as the stack of rings is used up, and indicates when it is time to reload the tube. Several vents, as shown at *H*, guard against the formation of gas pressure.

The hydraulically operated slide which discharges the contracted inserts is shown at *J*. It is illustrated in the discharging position. When the op-

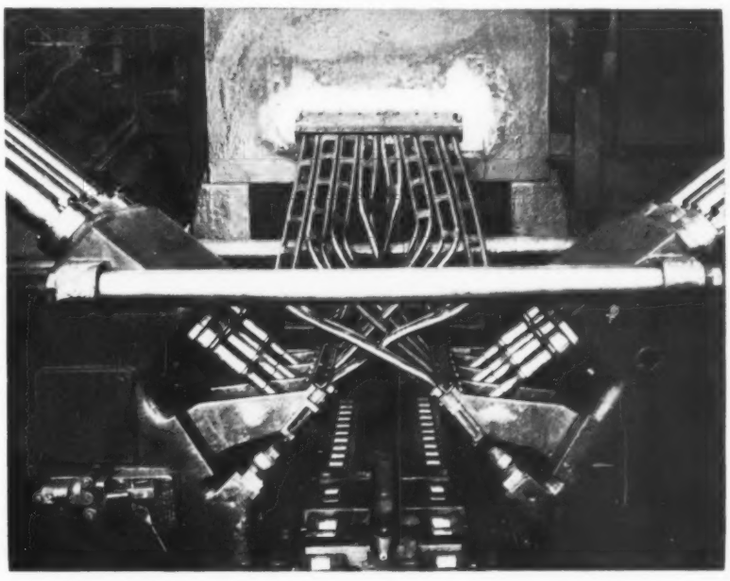


Fig. 2. Close-up View of Chutes that Bring Valve-seat Inserts to Cylinder Block and of Pneumatic Plungers that Push Them into Place

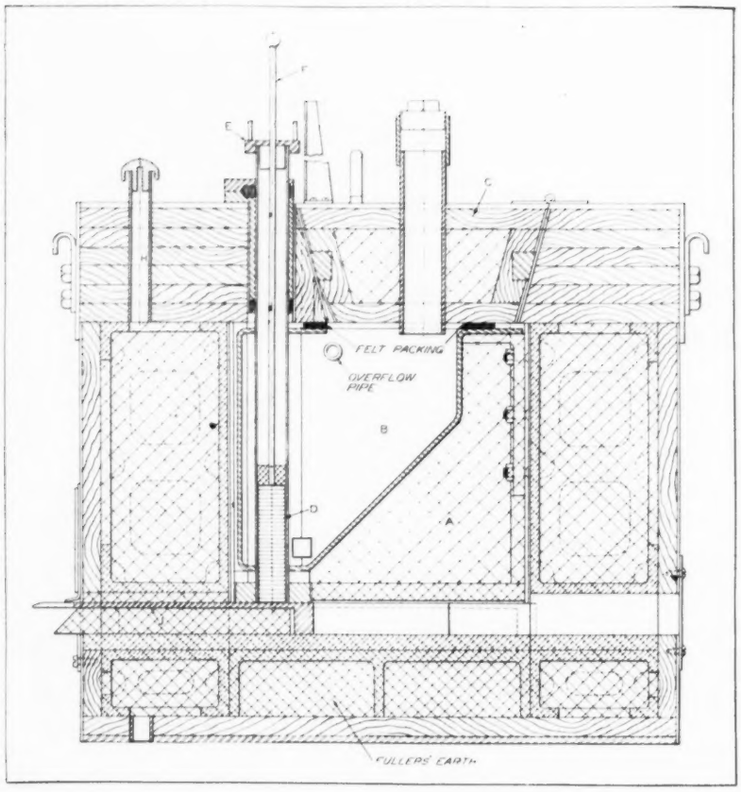


Fig. 3. Construction Drawing of a Refrigerator with a Temperature of Approximately 312 Degrees F. Below Zero. The Valve-seat Inserts Remain in This Refrigerator Fifteen Minutes or More and Contract Not Less than 0.009 Inch

erator presses the button to actuate this mechanism, slide *J* is withdrawn about 11 inches into the refrigerator, so that a valve-seat insert can drop from each of the eight tubes *D* into spaces between fingers at the front end of slide *J*. Then the slide is quickly advanced to the position shown to discharge the inserts into the chutes that lead to the assembling plungers.

The slide is made thin, so as to minimize the amount of air that reaches the tubes *D* from outside of the refrigerator. The slide is heavily plated with chromium to reduce wear and prevent rusting. At the rear end, slide *J* is connected to a pusher-bar, on which there is a rack that is engaged by a spur gear, driven by the hydraulic mechanism.

* * *

The Immediate Cause of Depressions and Recoveries

Whenever anything shocks public confidence with the possibility that prosperity may not last forever, large numbers of people stop spending for everything but necessities. The housewife uses her old furniture, curtains, carpets, and dish pans; we all decide to wear out our old clothes instead of buying new ones; we postpone buying a new car or new machinery for the factory; we postpone everything we can postpone. In many cases, these postponements are not really necessary.

In 1933 many people were actually ashamed to buy what they could well afford to buy, for fear somebody would think they were showing off. Every postponement of buying means unemployment, which continues until considerable portions of our household inventories and factory inventories are used up, and we are forced into the market. Recovery starts there and from that cause. It cannot be forced by low interest rates—or paper money—or propaganda. It is a purely natural process of wearing out. As soon as buying of these so-called non-essentials begins, each man going to work by his buying puts another man to work, and gradually [if there is no interference that retards recovery] a condition of full employment is re-established, as each one finds something to make or to do for which other people are willing to pay.

No scheme of social planning or government control *could* handle this process half so quickly and efficiently and inexpensively as the free actions of a free people, each person seeking out his own place in the scheme and spending his money as he pleases from day to day, thus creating a sound basis for the redistribution of labor and capital, which is unavoidable after every depression, with its temporary and permanent changes in the things for which people spend money.—*Industrial Canada*

* * *

A Steel Company Pays Tribute to Its Men

In recording the fact that the company has set a new record for production of its 76-inch hot strip-mill of 1677 tons in an eight-hour shift, the Inland Steel Co., Chicago, Ill., compliments the crew of the strip mill for its achievement, and states further that the company's 13,000 men, when operations were resumed July 1, came back and put the mill in capacity operation again with a remarkable spirit of pride of workmanship. The new production record is pointed to as a reassuring condition following an unfortunate and unnecessary strike, which kept the plant closed for a month.

* * *

The best plan in the world won't work unless it allows for the cussedness of human nature.—*The Houghton Line*

The Hydraulic Operation of Machine Tools

The Feeding and Traversing Movements of Cold-Sawing Machines, Shapers, and Broaching Machines are Obtained through the Use of Automatically Controlled Hydraulic Units—Fourth of a Series of Articles

A SYSTEM utilizing one pump for supplying the power for operating, while another feed and measuring pump governs the speed of the traverse has been developed by Gebrüder Heller of Germany. The measuring pump is maintained substantially free from load, in order to secure accurate measuring. An arrangement is shown in Fig. 12 where oil supplied by the pump *A* passes through the pipes *B* and *C* to the cylinder to produce counter pressure on the piston.

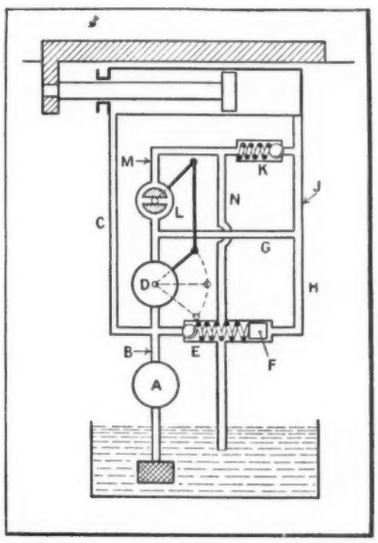


Fig. 12. Hydraulic Circuit with "Measuring" Pump for Controlling Rate of Feed

The oil required for the feed is also supplied by the pump *A*, but passes to the pump *D*, which is regulated to supply only definite quantities. The oil not required by the pump *D* is forced through the valve *E* and flows back to the tank. The spring in this valve is supported by the small piston *F*, behind which the oil pressure on the other side of the pump *D* is conveyed by the pipes *G* and *H*. In this way, obviously, the closing force exerted on the ball valve is dependent upon this pressure.

When the pump is adjusted for a certain delivery, the oil flows through pipes *G* and *J*, forcing the piston to the left. If the feed resistance increases, the pressure in the pipes *J*, *G*, and *H* increases, so that piston *F* tends to close the valve *E*. The supply pump now works against a higher pressure, while the same pressure prevails in the pipes *B* and *C* as in the pipes *G*, *J*, and *H*. The feed pump *D* is thus relieved from load, and has only the task of determining the feed. The increased power with a rising feed resistance has to be supplied by the pump *A*.

A safety valve *K* prevents the feed from exceeding a predetermined amount; and to obtain a rapid return, a rotary valve *L* is coupled to pump *D* to reverse the oil flow. Both pumps then supply oil through the pipe *C*, and the feed cylinder moves rapidly to the right. The exhaust oil flows back through the pipes *J* and *G* to the feed pump, any excess over requirements flowing through the open rotary valve to the pipes *M* and *N* and the tank.

Feed System for Cold-Sawing Machine

The application of this system to the Heller cold saw is shown in Fig. 13. An extension to the pipe *O* supplies oil from the gear pump *A*. Through a system of levers, a clamping pressure is applied to the work, both feed and clamping pressure being indicated by gages. For other machine tools, valve gears of the types described may be applied to suit varying conditions. Honing machines are particularly adaptable, a rotary valve operated by dogs on a dial being used in some cases; in other instances, a reversing piston-valve operated by a lever load-and-fire mechanism of any well-known mechanical type may be used. Gear-cutting machines can have hydraulic feed to the work-slide, governing

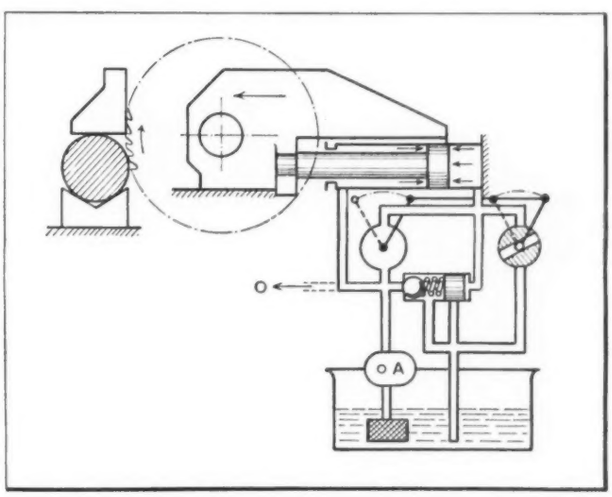


Fig. 13. Application of System Shown in Fig. 12 to a Cold-sawing Machine

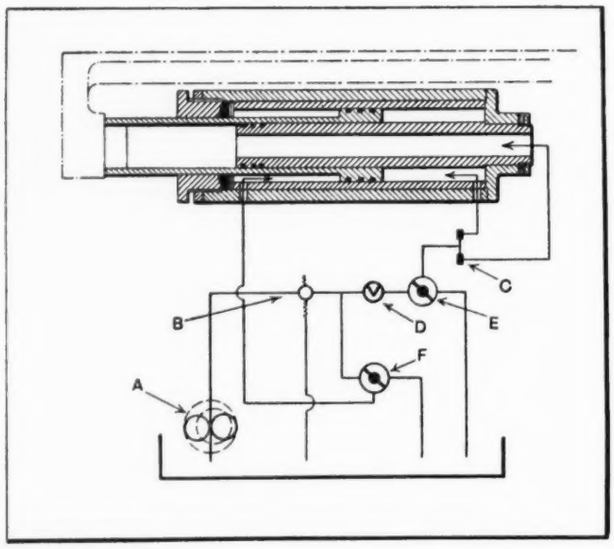


Fig. 14. Diagram Showing Hydraulic Circuit for Shaper

the rate at which the work is fed to the cutters until the full depth is reached.

A hydraulic circuit for operating a shaper similar to the Wotan (Soag machine tools) is shown in Fig. 14. In this diagram, *A* is the pump, *B* the relief valve, *C* the change-over valve, *D* the speed control, *E* the reverse valve, and *F* the reverse valve return. With this circuit, levers are provided for the convenient control of stroke engagement; speed control by pump adjustment; reversal of the ram; speed changes giving three speed groups up to 50, 72, and 100 feet per minute; table traverse feed change; table rapid traverse; and table traverse stop and reverse. Automatic stops and provision for hand operation and ram reverse dogs are incorporated in the design.

The hollow draw-rod feature is adopted to provide a quick return, which, differing from the mechanical drive, remains at a constant ratio at any stroke. A subdivision of ram areas on the pressure side enables a high finishing speed to be obtained, in addition to a high-powered lower speed for roughing.

Hydraulic System for Broaching Machine

A simplified control is obtained on the Lapointe hydraulic broaching machine by utilizing a hollow draw-rod, as shown in Fig. 15. In this case, oil is supplied by a West multi-plunger variable-delivery pump *A*, operating at a pressure of 1000 pounds per square inch, which is controlled by shaft *B* running parallel to the draw-head. A system of linkage connects a hand-operated lever and the control shaft to the pump. An automatic valve is attached to the pressure cylinder, which is so arranged that during the return stroke of the ram, the oil that produced the pressure on the cutting stroke is transferred from one side of the piston to the opposite side, only a small portion going through the pump.

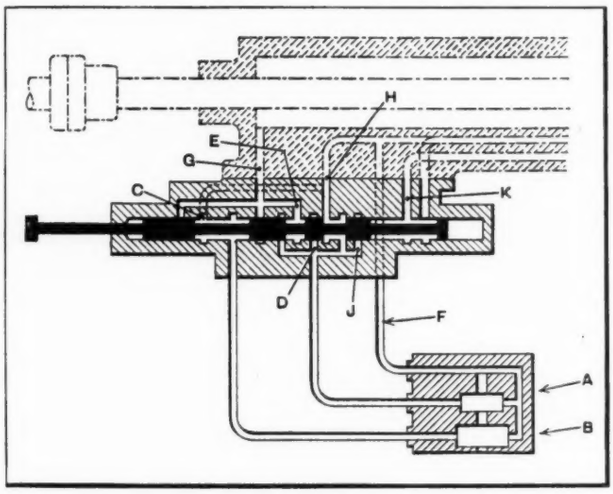


Fig. 16. Hydraulic System for Broaching Machine Employing Two Pumps to Give Three Cutting Speeds and Quick Return

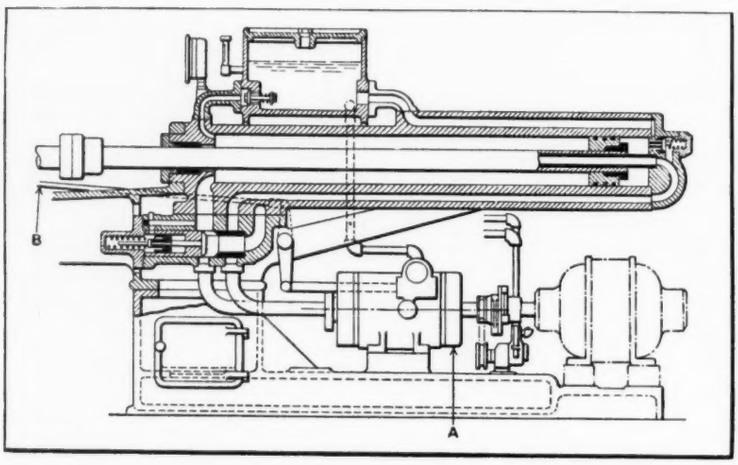


Fig. 15. Hydraulic System for Broaching Machine with Quick Return Provided by Hollow Draw-rod

On the return stroke, the oil is forced into the hollow draw-rod and, working against a small area, produces a return speed as high as 180 feet per minute. The reservoir above the cylinder provides oil for the system, and the level rises and falls due to the difference in areas on each side of the ram. The cutting speed can be varied without affecting the constant return speed, which can be set as required, while speed changes can be made, with the machine running or stopped, in a few seconds.

An alternative patented arrangement developed by the same company is shown in Fig. 16. This system uses one constant delivery pump *A*, and another *B* which supplies double the volume of pump *A*. The hollow draw-rod feature is used in conjunction with a piston-

valve which gives three cutting speeds, neutral, and reverse. This illustration shows the various members in the neutral position. The pump *B* passes oil to the valve casing through the port *C* to the return pipe and back to the pump casing. The valve is moved to the right for slow-speed operation, so that oil from pump *A* can pass through ports *D* and *E* to the cylinder, moving the piston to the right, oil being expelled from the right-hand end of the cylinder and the hollow draw-rod through the return pipe *F*. At the same time, oil from the large pump *B* circulates through the port *C* to the return.

The intermediate speed is obtained by moving the valve further to the right, so that oil from pump *B* passes through port *G*. The return connections are the same as before, and pump *A* circulates the fluid through ports *D* and *H* to the return. For the fast speed, both pumps combine in supplying oil through port *G*, which is open when the valve is moved to the extreme right.

Movement of the valve to the extreme left, so that the pump *A* is able to pass oil through ports *J* and *K* connecting with the inside of the hollow draw-rod, results in a rapid return to the left. The pump *B* meanwhile circulates oil through the port *C* to the return pipe.

* * *

The taxes on the motor car user, like the taxes on railways, rest rather heavily, and are obviously out of proportion to the amount of money spent by various governmental bodies for the benefit of motor car operation. In 1936, direct motor vehicle user taxes amounted to $1,400,000,000, and gasoline taxes, to $880,000,000 additional. This was 14 per cent of all taxes from all sources—federal, state, and local—in that year.

Standard Welding Symbols

The American Welding Society has developed and published a set of standard welding symbols covering both fusion and resistance welding. These symbols provide the means of placing complete welding information on drawings, with the idea that the drawing will give all the required information without an excessive amount of explanatory notes. In evolving the symbols, the need for simplicity has been kept in mind. Briefly, the scheme amounts to a shorthand system whereby a large amount of information is conveyed accurately by a few simple symbols, lines, and numbers. The charts can be obtained from the American Welding Society, 33 W. 39th St., New York City.

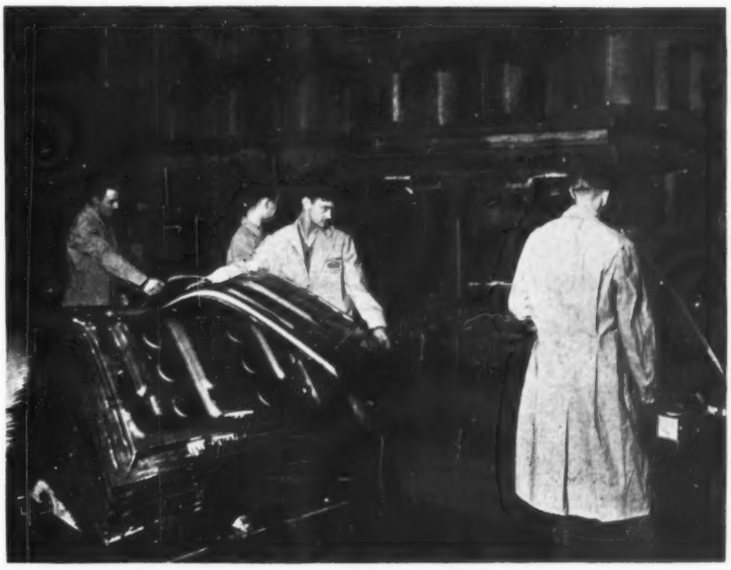
* * *

V-Belt Testing Machines

The Society of Automotive Engineers, 29 W. 39th St., New York City, announces that working drawings have been prepared by the Engineers Standards Committee of the Society from which a machine can be constructed to test V-belts by methods described in connection with the S A E Standard for V-Belts and Pulleys, as given in the 1937 S A E Handbook on pages 60 to 63, inclusive. These drawings are available to members of the Society at 50 cents per set, and to non-members at $1 per set.

* * *

Improvements in incandescent lamps in the last ten years have increased lamp efficiency by approximately 25 per cent. In other words, the user of electric light obtains today 25 per cent more light with the same amount of current consumption as he did ten years ago.



Four Dies Enable This Huge Press to Perform Four Distinct Operations at Each Down Stroke. The Two Dies on the Side of the Press Seen in the Illustration Trim the Inner and Outer Panels of Trunk Lids for Automobiles, while the Dies on the Opposite Side Perform Piercing and Flanging Operations on the Same Parts. This Press Set-up is Representative of Manufacturing Practice in the Recently Built Grand Rapids Stamping Division Plant of the General Motors Corporation

"Winding" Rotors by Casting

By FRANK S. DOBRIC
Electrical Engineer
Reliance Electric & Engineering Co.
Cleveland, Ohio

THE necessity of obtaining a good connection between the rotor bars and the end rings of squirrel-cage induction motors has led to various methods of fabrication, such as soldering, brazing, and welding. A further development is to cast the rings, bars, and ventilating fans in one piece. The casting method avoids all risk of loose or defective joints, and, in addition, permits changes in the shape and cross-sectional area of the bars which would be impracticable with rod or wire of commercial standard gages. By modifying the shape and area of the slots in the laminations, and consequently of the bars that are cast in these slots, a wide variety of combinations of starting torque, starting current, power factor, and ratios of load to speed can be produced. Moreover, since the rotor "windings" are cast under a high pressure, greater uniformity is obtained.

In the production of rotors by the casting method at the plant of the Reliance Electric & Engineering Co., the laminations are first stacked on a mandrel equipped with a skewed key, as shown in Fig. 2. This gives the laminations the necessary skew to provide an even torque in all rotor positions, and it eliminates any tendency of the rotor to lock when the motor is started. The laminations and mandrel are then preheated, as shown in Fig. 3, so that these assembled parts will not chill the molten metal in the casting operation before the mold is completely filled.

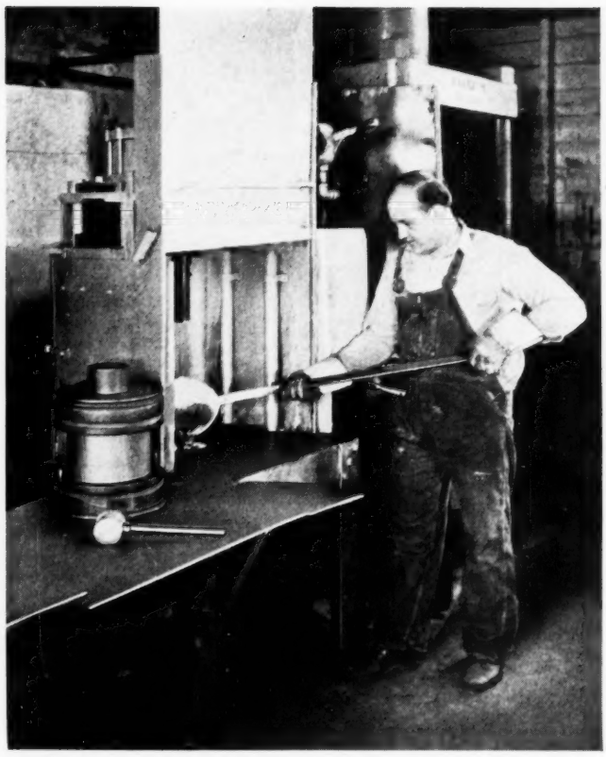


Fig. 1. Pouring Molten Aluminum Alloy into the Chamber of the Casting Press preparatory to Casting the Rings, Bars, and Ventilating Fans of a Rotor in One Piece

The preheated assembly is next made up into a three-part mold, as illustrated in Fig. 4. The bot-

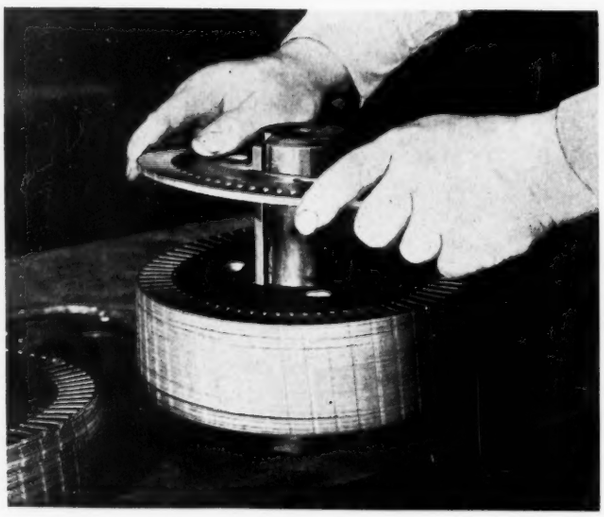


Fig. 2. Stacking the Rotor Laminations on a Mandrel preparatory to the Casting Operation

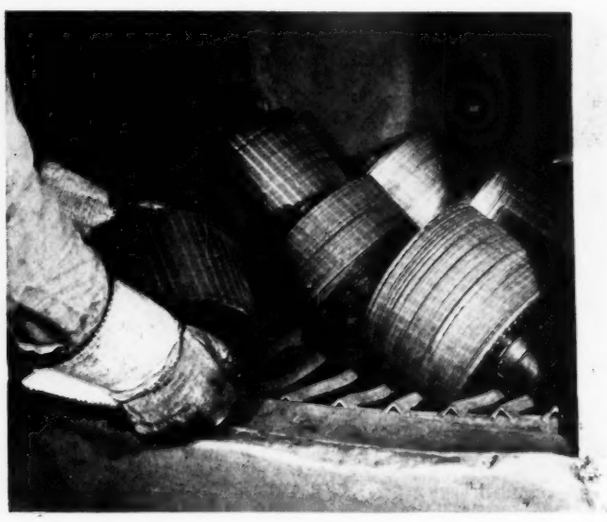


Fig. 3. Preheating Assembled Rotor Laminations to Avoid Chilling in the Casting Operation

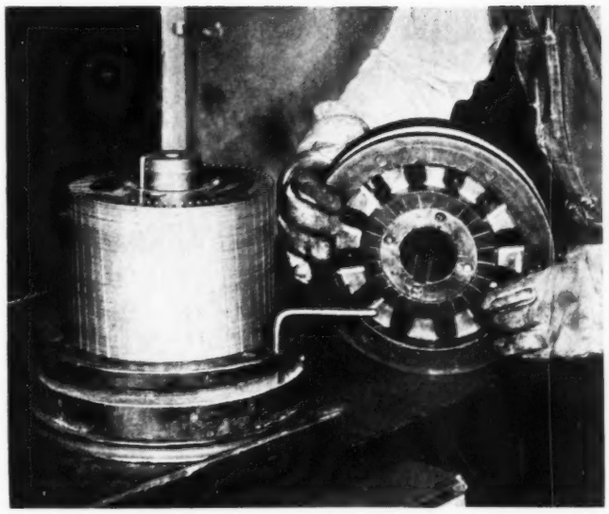


Fig. 4. After Preheating, the Laminated Core is Assembled into a Three-piece Mold

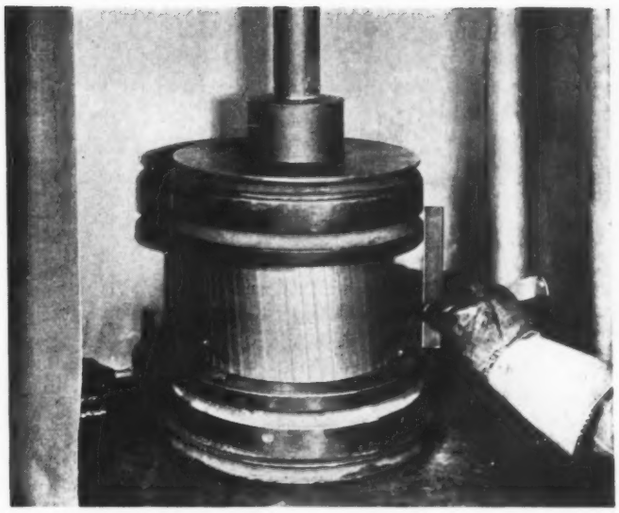


Fig. 5. Before Casting, the Length of the Rotor Core is Measured while under Pressure

tom of the mold is solid, except for gates through which the molten metal is to be forced. The end rings and the rotor fans help to make up the mold, the rotor laminations forming the bar portions.

After the mold has been assembled, it is placed in position on a press provided with top and bottom rams. These rams are individually controlled through air-pressure cylinders. The molten metal is, however, first ladled into an asbestos-lined chamber above the lower ram, as shown in Fig. 1. After the assembled mold has been placed over this chamber, a heavy pressure is applied to compress the laminations to the required core length, and this dimension is carefully checked, as indicated in Fig. 5.

Molten metal at a thermostatically controlled temperature of 1250 to 1350 degrees F. is then forced upward into the mold by applying a pressure of 50 to 60 tons, the molten metal being forced through the gates in the bottom of the mold and then through the slots in the laminations. The pressure is released after the metal has had time to set, which usually requires only a few seconds.

The lower or gated section is then sheared off the casting and the ring molds removed, as shown in Fig. 6, after which the mandrel is pressed out, as illustrated in Fig. 7, and a keyway is broached in the core for locking the rotor on its shaft.

Aluminum is used in this casting process for the ordinary type of motor, but for motors requiring higher rotor resistances, alloys of magnesium are employed. The casting method of "winding" is regularly employed by this concern for squirrel-cage motors up to and including 30 horsepower. Although this method was thought impracticable for larger sizes, rotors having integrally cast bars, short-circuiting rings, and ventilating fans are being made in sizes up to 150 horsepower.

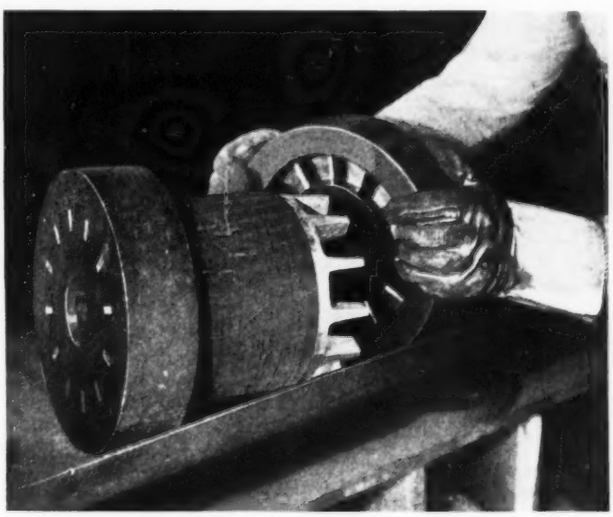


Fig. 6. After Casting, the Gated Section is Sheared off and the Ring Molds are Removed

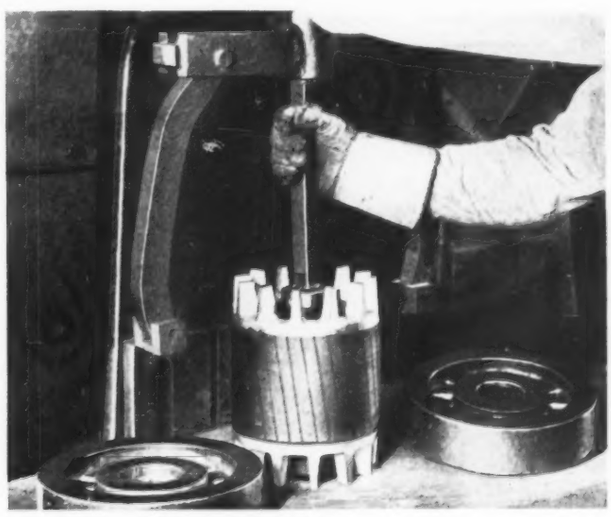


Fig. 7. Finally the Mandrel at the Center of the Core is Pressed out and a Keyway is Broached

General Requirements of Fixtures for Tapping

By H. GOLDBERG
Vice-President
R. G. Haskins Co.
Chicago, Ill.

A Few of the Important Principles that Must be Observed in the Design of Efficient Tapping Fixtures

MANY of the troubles met with in tapping to close tolerances are caused by the use of unsuitable fixtures. While the average tapping fixture can and should be of very simple design, there are certain fundamental principles that must be observed. Generally, not enough consideration is given to providing clearance space for chips. The method of supporting the work while tapping is often faulty. Sometimes variations in the size of the work make it difficult to locate the piece with reference to the tap. This is a problem that becomes of especial importance when tapping at high speeds.

A hole that is out of line with the tap, especially in the smaller tap sizes, usually bends the tap, causing trouble when it reverses, as it has a tendency to straighten itself when backing out, and this, in turn, makes the tap cut backward. This also promotes tap "loading" and shortens the life of the tool.

Too much play between the part being tapped and the locating points in the fixture is likely to cause considerable trouble, because the work has a chance to shift either while tapping or reversing. Such play has a tendency to throw the hole out of line with the axis of the tapping machine, so that the tap enters at a slight angle. This will cause trouble when the tap is reversed.

In tapping irregularly shaped castings, where there is a slight variation in size and accurately machined locating surfaces cannot be used, it is difficult to hold the size of the tapped hole, as the fixture must permit sufficient clearance for the variation in the castings. In that case, the tap will have a tendency to cut a bell-mouthed hole.

Many of these difficulties can be overcome by clamping the parts in the fixture; but this requires additional time, and in most cases, is not necessary, if proper consideration is given to the locating points in relation to the fixture, as it is usually possible to find some points that can be used for locating where no great variations are present.

A Few Points to be Considered in Designing Tapping Fixtures

Thin sections should be well supported directly beneath the tapped hole, so that there will be no deflection of the work from the pressure of the tap.

In high-speed tapping, especially with taps 5/16 inch or less in diameter, the tapping time is usually much less than the time required for handling the work. In such cases, it is important that the fixture be designed to require the minimum of handling time. This involves consideration of such points as the height of the fixture, so that the hand is not crowded while placing the piece in it; the angle at which the part is placed in the fixture relative to the operator; whether the part can be best placed from the right-hand or from the left-hand side; whether it is more practical to place it at an angle; or whether it is easier and quicker to push it into position from the front of the machine.

All this depends upon the shape, size, and weight of the part. Then the matter of removing the piece after tapping must be considered. Does it lend itself to being pushed through the fixture or can some kind of spring ejector be utilized? After removal, should it be placed in a pan or can it be dropped into a chute? If the latter can be done, it usually saves time and increases production.

It is a mistake to have unusually long fixtures for small pieces and to slide the part through the fixture, as the sliding time is sometimes greater than the tapping time. When parts can be fed through an open fixture, a disappearing pin or ball-stop is often advantageous, as it relieves the operator of eye-strain in locating the tapped hole.

Guide Bushings for Taps are Usually Objectionable

Sometimes when the work requires that the tapped hole be in an accurate position parallel to, or in line with, some other hole, boss, or locating surface, a standard drill bushing is used for locating the tap. These drill bushings are detrimental to the life of the tap, as they have a tendency to round over the outside edges.

Whenever bushings are absolutely necessary, it is advisable to make them of the revolving type, and, if possible, mount them on ball bearings. In that case, the tap will not have to rub against the hardened walls of the bushing. When bushings are used, special attention must be given to the method of getting oil into the tapped hole, as a tap revolving at high speed will swing the oil out against the walls of the bushing, actually creating a seal which will permit very little oil to find its way into the tapped hole.

If there are several holes to be tapped in a piece

and the fixture must be moved for each hole, the fixture should be made as light as possible, as its weight will have a direct bearing on the production. For instance, if there were ten holes to be tapped in a piece and it were possible to tap a thousand holes an hour, the fixture would have to be moved a thousand times an hour. If it weighed as much as thirty pounds, one would have to move thirty pounds one thousand times an hour, which places a considerable burden on the operator. The lighter the fixture can be made, the better.

In tapping second-operation screw machine work made from bar stock, the parts must be clamped while being tapped. The jaws or clamping members of such a clamping fixture should be made self-centering. If a vise with one movable jaw is used and there is any variation in the diameter of the work, the tapped hole will be thrown out of line with the tap. If the part is clamped rigidly, it throws an unnecessary strain on the tap, and more metal will be removed from one side of the hole than from the other. As a result, there is difficulty in holding the size of the threaded hole. Ample provision must be made for chips. Many of the conventional vises lack the required chip room and ease of handling for high-speed tapping.

Electroforming Iron Molds for the Plastic and Rubber Industries

By J. GILBERT MALONE

THE cavities of dies and molds used by the plastic and rubber industries can now be produced by the electrical deposition of iron in a process developed by the writer during the last two years. With this process, an iron shell is obtained for use as the cavity of the die or mold. This shell has all of the intricate impressions that may be desired in the mold without any engraving or die-sinking operations having been necessary.

The shell can be electroformed to any required thickness. However, the thinner it is, the lower the cost will be, because less time will be required for the electroforming. For example, if a shell 3/16 inch thick requires seventy-two hours of electroforming, a shell 1/16 inch thick of the same contour will take only twenty-four hours.

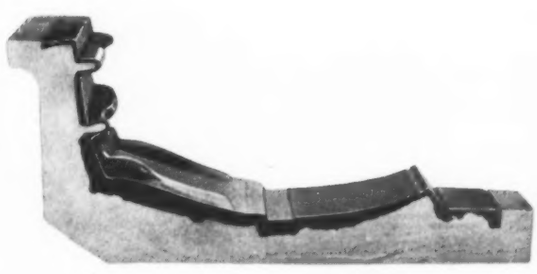
The electroformed iron shell is made into a mold by backing it up with molten metal or by welding it to a steel plate and then machining the outside surfaces to the required external dimensions. The illustration shows a cross-sectional view through an automobile tire mold constructed from an electroformed iron shell and an aluminum backing.

The electroforming process starts with a master model that is a replica of the part to be formed in the mold or die. This model can be made of plaster, wood, metal, rubber, molding clay, etc. From the master model a negative is made from Cerrobase, an alloy of low melting temperature produced by the Cerro de Pasco Copper Corporation, New York City. This Cerrobase negative is then used for electroforming a working master of iron, which is a duplicate of the original master model and of the part to be produced. On the iron working master any number of die or mold shells can be electroformed from iron with all the detail—and also the imperfections—of the original master. Details as fine as 7000 lines per inch have been reproduced.

Normally there is no adhesion between the iron working master and the die or mold shell, but if there should be such a tendency, it can be avoided by dipping the working master into chromic acid just before placing it in the plating bath. However, if the edges of the working master are not protected, iron will be electroformed on them and the shell and master cannot be separated until the parting edge has been cut free.

As a matter of routine practice, it is a good plan to have an engraver remove any imperfections from the working master that have been carried over from the master model and also to give the working master a high polish. The die or mold shell produced by electroforming can be hardened.

The widest application of this process thus far has been in making automobile tire molds, but the writer is of the opinion that from the standpoint of savings per unit of manufactured article, the plastic industry will probably derive the most from this development. This electroforming process has also been used in making die-casting dies.



Cross-section of a Rubber Tire Mold Made from a Shell of Electroformed Iron Backed up by Aluminum

Engineering News Flashes

The World Over

World's Largest Air Liners

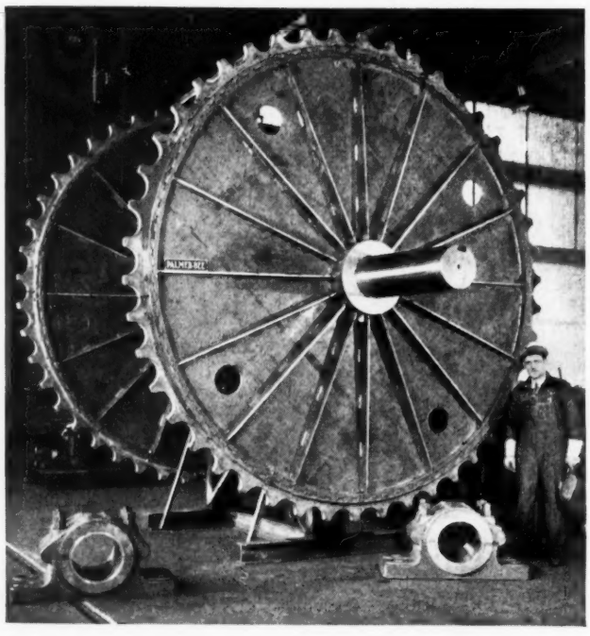
Fourteen great air liners, which will be the largest in operation in the world, are being completed for the British Imperial Airways. Their wing span is 127 feet, and their length 114 feet. Fully loaded, they will weigh 20 tons, and will operate at a maximum speed of over 200 miles an hour. Each airplane will be equipped with four engines, built into the leading edge of the wings, providing a total of 3400 horsepower. The fuel tanks will be built into the wings. The planes will be able to make 1000-mile non-stop flights against a head wind of forty miles an hour. When all the new planes are in operation, there will be five flights to Calcutta in India and back each week. In European day services, the planes will carry forty-two passengers and a crew of five, while on the so-called Empire routes, they will carry twenty-seven passengers by day or twenty in sleeping berths at night.

The "Thermo-Tector," A New Thermal Overload Switch

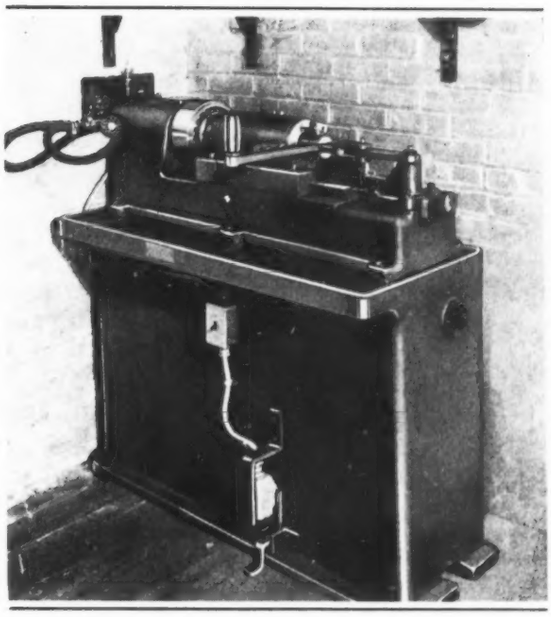
A thermal overload switch for fractional-horsepower motors operating on line current has recently been developed by the General Electric Co., Schenectady, N. Y. It is completely self-contained and has no links or plugs to be replaced. Known as the "Thermo-Tector," the device automatically disconnects the motor from the line when overload occurs, before the motor reaches a dangerous temperature; then when the motor has cooled, it is automatically reconnected to the line, the entire operation being repeated at safe intervals until the motor is freed from overload or is removed from the line. If the automatic reset feature is not required, a form of the new switch is available that can be used to disconnect the motor from the line and leave it disconnected until the device is reset manually.

Lenses from a Molded Plastic Product

News comes from London, England, of an invention through which lenses for cameras, binoculars, telescopes, spectacles, scientific instruments, etc., can be produced by a molding process from a plastic material similar to glass. These lenses are said to be, for all practical purposes, unbreakable; they weigh only half as much as glass; and they are obtained from the molds in a condition that requires no grinding or polishing. If this startling piece of news is based on facts, it would mean a revolution in the lens industry; but from the meag-



A 13-foot Diameter Sprocket Wheel, the Largest of Its Type Ever Made, Fabricated by Electric Welding with Much Greater Accuracy than Obtained by Former Methods of Construction. The Wheel Consists of a Hub 15 Inches Thick, 17 Inches Outside Diameter; a Web 3/4 Inch Thick, 12 Feet Diameter, Stiffened by 3/4-inch Plate Braces; a Rim 2 Inches Thick by 5 Inches Wide; Teeth Formed in Eight Steel Castings—Seven of Six Teeth Each, and One of Four Teeth. These Parts were Fabricated by the Palmer-Bee Co., of Detroit, Using Lincoln Shielded Arc Welding



To Test the Quietness of Bearings, the Timken Roller Bearing Co. has Developed a Machine which is Installed in a Soundproof Room. This Machine Allows Bearings to be Loaded with Any Pressure up to 1000 Pounds. The Machine can be Run at a Constant Speed or the Speed can be Accelerated or Decelerated as Desired, and the Quietness of the Bearing Noted under the Different Conditions

er information available, it is impossible to judge as to whether the invention will really prove practically important.

Electric Speedometer for Locomotives

An alternating-current speed indicator for steam, Diesel, and electric locomotives has recently been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. This electric speed indicator consists of three elements: (1) A simple electric generator mounted on the axle, which is connected by wires to (2) a rugged indicating instrument for mounting in the locomotive cab, and (3) a junction box with a variable resistance to compensate for wheel wear. Because of the distance from the wheels to the locomotive cab, a mechanical drive cable, such as is used on automobiles, is not conveniently applied. The speedometer instrument, which is mounted in the cab, is calibrated in miles per hour.

Some Advances in Steam Turbine Engineering

The steam power plants in the United States burn about the same amount of coal now as they did in 1920, according to E. L. Robinson of the General Electric Co., but they generate twice as much electricity with it. Part of the increase in efficiency results from the use of higher temperature steam, with accompanying higher operating temperature for all parts of the turbine. A modern turbine shell runs, almost literally, red-hot.

Since the metal used in a turbine rotates at very high speed, and must at the same time withstand unusually high pressures, it is important that the steel used be selected to meet the requirements. At the turbine plant of the General Electric Co. in Schenectady, automatic electric furnaces are held at the same temperatures that occur in the turbines when in operation. In these furnaces, rods of turbine materials, under constant tension, are tested for years at a time. The measuring gages in the furnaces indicate changes in the length of the rods of one part in a million. It is possible to watch from week to week the "creep" of these heated and stressed rods, and to determine what stresses can be used without excessive distortion.

The Bicycle is Staging a Comeback

The manufacture and sales of bicycles in the United States have shown a considerable upward trend during the past year or so. In several European countries, the bicycle has always been a valued means of transportation, and information from abroad indicates that the demand is constantly growing. The British export trade in bicycles has increased greatly within recent months, one Birmingham company reporting an increase of over 50 per cent in the export of bicycles, as compared with the same period last year.

Diesel Engines Predominate in New Ships

According to a recent report published by *Lloyds Register of Shipping*, more new ships—both by numbers and by tonnage—are now being provided with Diesel engines than are equipped with steam engines. Last year, 530 Diesel-engine ships were launched in the world's shipyards, representing a total of 1,202,000 tons, while only 416 vessels provided with steam engines or turbines, aggregating 878,000 tons, were launched. Measured by the tonnage of ships built, Great Britain led in 1936, followed by Germany, Japan, Sweden, the United States, and Denmark, in the order mentioned.

EDITORIAL COMMENT

Looking for Trouble Instead of Using Common Sense

Earlier in the year, Mr. Hopkins, head of the Works Progress Administration, outlined a twenty-year program for taking care of unemployment. It is not a pretty picture that he draws when he predicts a permanently large number of jobless persons; and while he also predicts the end of poverty in America, he proposes to attain this end simply through various forms of governmental aid, which is a sad commentary on the manner in which our economic problems are being worked out.

"When industry stopped in 1929," says Mr. Hopkins, "the research workers did not stop, so that we now need less people to maintain the 1929 level of production."

Why is it that so many men in government, business, and labor circles insist that 1929 production must be considered the peak beyond which we must not hope to progress? Certainly our production engineers would not be worth their salt if they had not devised improvements in the 1929 methods for performing the work of 1937. Certainly fewer men should be able to get out the equivalent of the 1929 production at the present time. Thus only can the standard of living be raised. The men released can then turn their working ability toward producing *additional* goods and services that will make for greater comforts for all.

We never had enough production in this country to provide the kind of living for everybody able and willing to work that technical progress makes possible. The President has well said that a large percentage of the population does not enjoy what we have been pleased to call an American standard of living; but he omitted the necessary corollary—that such a standard of living can be made available for our entire population only through work, only through production, only through training that will fit every able-bodied man to perform his part as a producer in a progressing world.

Were our efforts concentrated in that direction, we would not need to worry about having to look forward to governmental aid for a large percentage of our population. To be sure, there will always be some unemployable, but beyond that comparatively small percentage, everybody fitted to do useful work should aid in increasing the total "pile" of goods produced, out of which each would be entitled to receive his proportionate share; and that share would obviously be greater, the greater the production. To this end, governmental policies should help, not hamper, industrial enterprise.

It is that kind of constructive economics that we need in our government—not the pessimistic, defeatist kind that present policies suggest. It is one of the great contradictions in our national life that men capable of increasing production and improving the standard of living of all of the people have to fight for this "privilege" against the combined opposition of those who would most benefit by such progress.

Measuring Business Progress Mainly by Sales Volume

The history of American industry indicates how strongly inclined we are as a nation to think of volume-business as the most significant indication of real progress. This volume-mindedness has had a great deal to do with our booms and depressions. Extremes in one direction have led to extremes in another.

The idea that to stand still is to go backward, as applied both to individuals and to business enterprises, has been preached so persistently that it has been accepted as an axiom needing no proof. A little thought will show, however, that it is not necessarily applicable to volume production. It is not necessary for a business to be standing still, even though it does not increase its volume from year to year. On the contrary, some of the most progressive businesses are not noted for great increases in volume. Their progress is expressed in the design and quality of the product that they make. It may also be noted in the manufacturing methods that they employ and the service that they render their customers. Even the return on the capital invested may materially increase without a marked increase in the volume of sales, because costs may be reduced by improved production methods, and because of quality, the product manufactured may command a higher price.

Up to a certain point, volume is necessary for economical production; but there is a point beyond which increased volume is of no particular value, either in reducing costs or in increasing the percentage of return on the capital invested.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

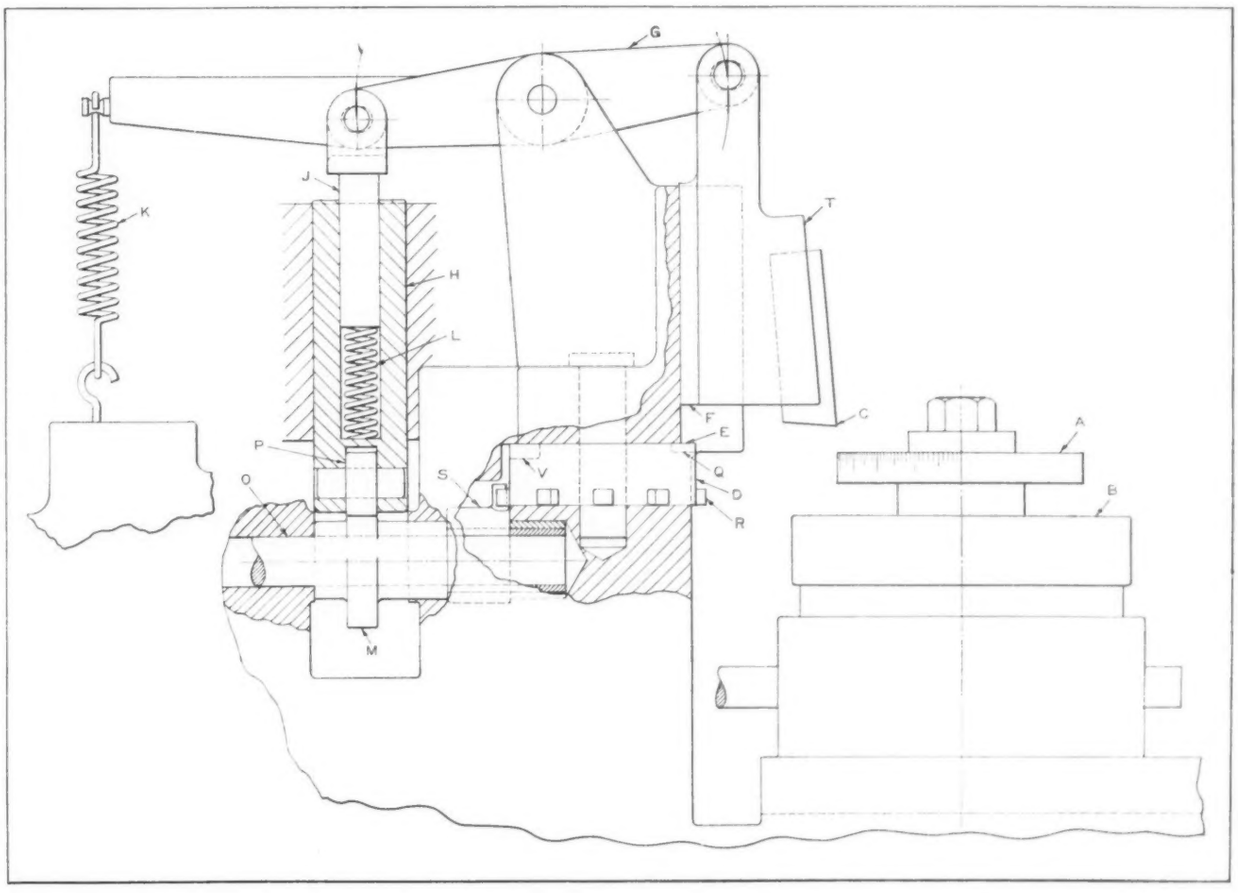
Variable-Stroke Mechanism for Graduating Feed-Screw Dials

By I. F. YEOMAN

The variable-stroke mechanism shown in the accompanying illustration moves the head *T* up and down in synchronism with the indexing movement of the drum *D*, which stops the downward movement of the head as required for the production of the three different lengths of graduation lines on the work or dial *A*. The dials thus graduated are used on the cross-feed screws of turret lathes.

Referring to the illustration, the cutter-head *T* is actuated by the lever *G* and the connecting link *J*, which enters the sleeve *H*, in which it is securely held against the spring *L* by means of the spring *K*. The roll *P* at the lower end of sleeve *H* contacts with cam *M*, mounted on the main drive-shaft *O*. With this arrangement, the cutter-head *T* makes a full stroke at each revolution of the drive-shaft *O* and cam *M*.

The lengths of the graduation lines on dial *A* are controlled by the hardened steel circular drum or anvil *D* which comes in contact with the projection *F* on the sliding head *T* and thus interrupts the downward movement. While the cutter *C* is clear of the work, the anvil *D* is indexed by means of cam *S* on the main drive-shaft. Ten strokes of the cutter-head are required to complete the lines on one main division. Ten teeth, such as shown at *R*, are provided for indexing the anvil one complete revolution. Four of the strokes are interrupted at the short lines by the top face *E* of the anvil.



Dial Graduating Mechanism which Automatically Varies Length of Stroke to Suit Different Lengths of Graduation Lines

At the fifth indexed position, a slot *Q* in the face of the anvil receives the projection *F*, thus lengthening the stroke for the intermediate graduation line. A slot *V*, similar to the one at *Q* but diametrically opposite, allows the projection *F* to descend far enough to cut the longest graduation line.

The compression of spring *L* compensates for the various lengths of line. This spring also forces the cutter-head downward as sleeve *H* is lifted by cam *M*. Spring *K* serves to return the cutter-head to its uppermost position after the completion of the downward stroke. The faceplate *B* is indexed by a separate mechanism (not shown), which is properly synchronized with the variable-stroke mechanism.

Quick-Change Two-Speed Belt Drive

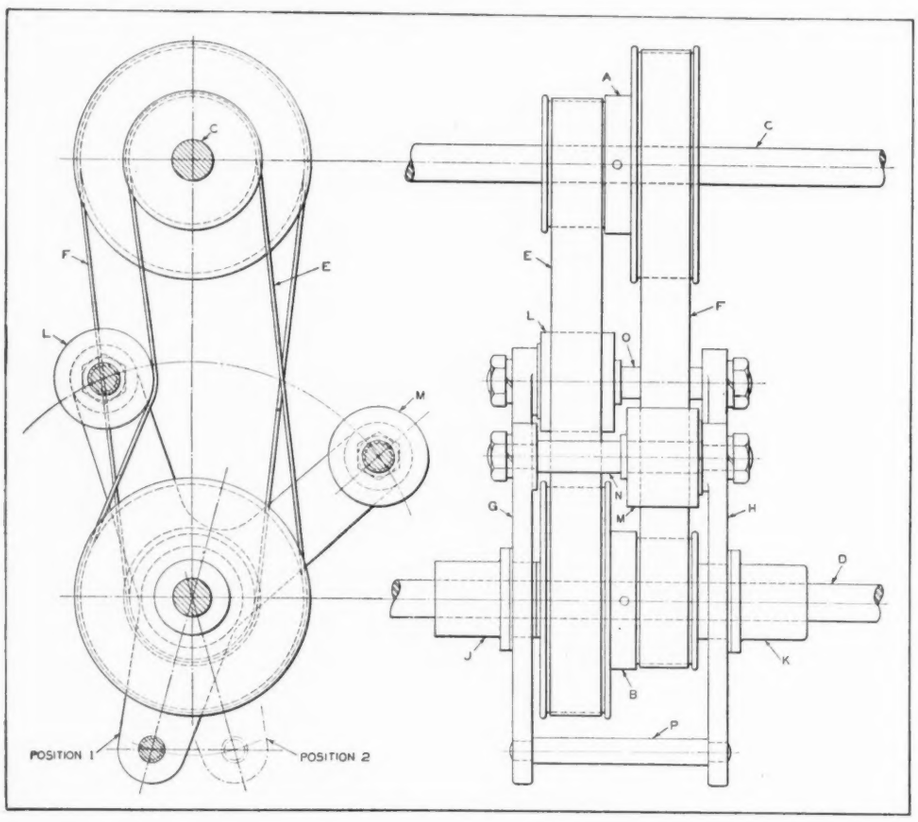
By JOSEPH WAITKUS

The two-speed belt drive shown in the accompanying illustration was developed recently for use on a certain machine. The design provides two speeds without the usual requirement of shifting or moving belts. Two sets of pulleys *A* and *B*, fastened to the driving shaft *C* and the driven shaft *D*, respectively, by means of pins, are employed.

Belts *E* and *F* are applied to their pulleys rather loosely. The rocker arms *G* and *H*, pivoted on the bearings *J* and *K*, are provided with two idler wheels *L* and *M*. Spindles *N* and *O* serve to carry the idler wheels and tie the two rocker arms together into a single unit. The bar *P* provides a means of connecting the rocker unit to a suitable actuating mechanism.

The operation of the drive is very simple. In the particular application illustrated, a very slow starting speed is required. After the driven pulley has reached the starting speed, it is immediately accelerated by shifting the drive to the next pulley. In other words, the rocker unit is placed in position 1 for starting, and is finally shifted to position 2. In thus operating the drive, the tension is first placed on belt *E* for slow speed and then shifted to belt *F* to obtain the high-speed drive.

In addition to providing a very easy means of varying speeds, this drive also permits placing the equipment at a remote place and controlling the speed through suitable linkage to the bar *P*.



Two-speed Quick-change Belt Drive

Mechanism for Intermittently Rotating and Locking Four Equally Spaced Shafts

By LOUIS CHABRAND

The shaft *A* of the mechanism shown in the accompanying illustration transmits 1/3 horsepower at a speed of 180 revolutions per minute, and can be run at this speed in either a clockwise or a counter-clockwise direction. In turning in a clockwise direction, as indicated by the arrow, shaft *A* rotates the gears *B*, *E*, *C*, and *D* intermittently and successively in a counter-clockwise direction. The drive to these gears is obtained through the combined or successive action of cam groove *M*, segment gear *H*, and cam groove *N*. The segment gear is keyed to shaft *A* and the cam members are adjustably fastened to the segment gear by studs *K*, dowel-pins *I* being used to maintain the permanent settings of the cams after they have been adjusted to the required position.

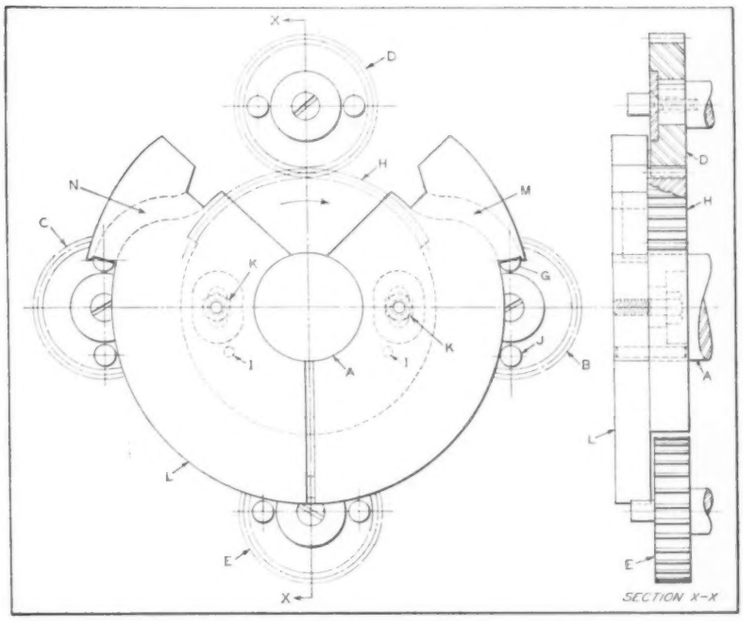
Starting with the various members of the mechanism in the positions shown, one-half turn of shaft *A* will rotate gear *B* one revolution. Gear *B* is then locked in a fixed position

until shaft *A* makes one complete revolution. As the four gears *B*, *E*, *C*, and *D* are spaced 90 degrees apart, the driving movement imparted successively to each of these gears begins when the preceding gear has made only one-half of a revolution. For example, when gear *B* has been given one-half turn, the gear *E* begins to turn. Similarly, when *E* has made one-half revolution, gear *C* begins to revolve.

A feature of the mechanism is its silent operation, which is obtained by employing the cam grooves *M* and *N* for respectively starting and stopping the driving movements imparted to the four gears, the segment gear *H* providing the intermediate driving movement.

In operation, the cam groove *M* engages the pin *G* and thus drives the gear *B*, accelerating its speed until the speeds of the two members are the same. This engagement of the members is accomplished without shock. The segment gear and the pinion *B* are thus engaged without shock when their pitch line velocities are the same. The segment gear continues to drive gear *B* until pin *J* enters the second cam groove *N*, the gear remaining in contact with the teeth of the gear segment until the cam groove has fully assumed its driving function. The cam groove *N* is designed to impart a decelerating movement to gear *B* until it has stopped. The concentric edge or rim *L* of the cam member now being in contact with the two pins *G* and *J* serves to lock gear *B* in a fixed position and hold it thus until cam groove *M* again engages the pin *G*. Each of the gears *E*, *C*, and *D* is successively rotated one revolution and then locked in a fixed position, the same as gear *B*.

This mechanism can, of course, be changed so that the intermittent drive will be imparted to one, two, or three of the gears as desired. Also, it can be so modified that the gear or gears will be driven only by the cam groove. The contour of the cam groove *M*, for example, can be changed so that it will impart either accelerating or decelerating movements to the gear, and can also be made to include a dwell. The speed of shaft *A* can also be increased, and its rotation can be reversed.



Mechanism by Means of which Shaft A Intermittently Drives and Locks the Four Gears B, E, C, and D

* * *

Automobile Factory Employment Reaches High Peak

More men have been employed in the automobile industry during the 1937 season than in any preceding year, according to figures published by the Automobile Manufacturers Association. The industry employed, during the eight months beginning October, 1936, an average of 522,000 men. The previous record was in the first eight months of 1929, when the average reached 489,000 men.

Machine Shop Practice Division of the A.S.M.E. to Meet in Atlantic City

The Machine Shop Practice Division of the American Society of Mechanical Engineers will sponsor one of the technical sessions at the annual meeting of the American Welding Society to be held October 18 to 22 at Atlantic City, N. J. This session is scheduled for Tuesday afternoon, October 19. Two papers will be presented—one on "Resistance Welding Fabrication," by J. M. Cooper of the General Electric Co., and the other on "Fusion Welded Fabrication," by H. N. Blackmon of the Westinghouse Electric & Mfg. Co. The meeting will be held at the Traymore Hotel, also the headquarters for the annual meeting of the American Welding Society, which is held simultaneously with the annual National Metal Exposition staged in Convention Hall, Atlantic City.

* * *

Inspection Machine Aids in Doubling Tube Production

Four Hele-Shaw fluid power pipe testing machines recently installed in a large eastern tube mill by the American Engineering Co., Philadelphia, Pa., which are used to apply hydrostatic tests to tubes in 50-foot lengths, and in diameters from 2 to 16 inches, are said to have more than doubled the production of the tube mill, because of the rapid manner in which the tests can be applied, as compared with former methods. The forming and welding units were capable of increased production, but were limited by the testing equipment. Pressures from 500 to 3500 pounds per square inch can be applied by the new testing machines.

Drilling and Sawing Packard Pistons

ONE hundred and eighty pistons are completed an hour in the plant of the Packard Motor Car Co., Detroit, Mich., by a machine that drills seven holes, saws three slots, and cuts two lock-wire grooves in the wrist-pin holes. This machine was built by Greenlee Bros. & Co., Rockford, Ill. It is equipped, as illustrated in Fig. 1, with a three-station drum which is hand-indexed after the various tool-heads have withdrawn to their starting position at the end of an operation.

The fixtures provided at the three stations of the drum are designed to hold two pistons each. One of the pistons is held with the wrist-pin holes in line with the spindles of multiple heads mounted on slides at the opposite ends of the bed, while the other piston in the same fixture is held with the wrist-pin holes at right angles to these spindles.

From the loading station, the fixture is indexed forward and downward through 120 degrees by imparting a complete revolution to the crank at the front of the drum housing. Mechanical safety devices prevent double or reverse indexing under working conditions; however, the mechanism that prevents reverse indexing can be released when necessary to permit turning the drum backward. Indexing of the drum has been facilitated by mounting it on ball bearings of large diameter.

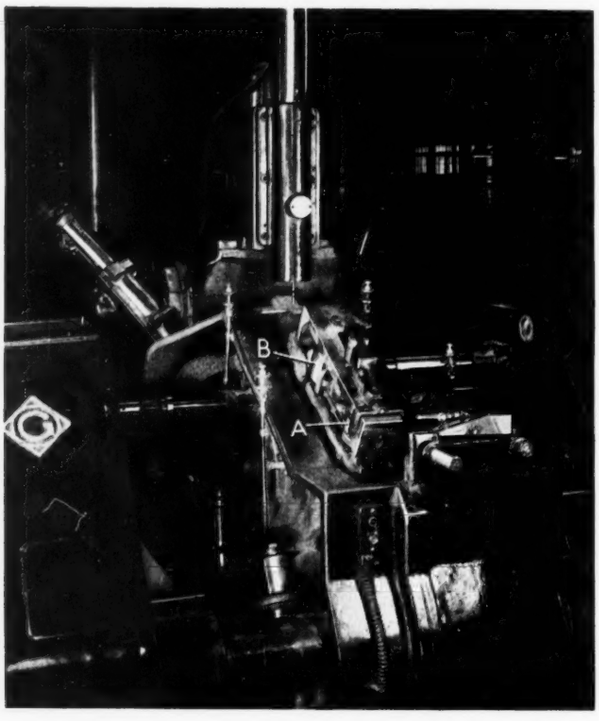


Fig. 1. High-production Machine which Drills Seven Holes, Saws Three Slots, and Cuts Two Grooves in Automobile Pistons at the Rate of 180 an Hour

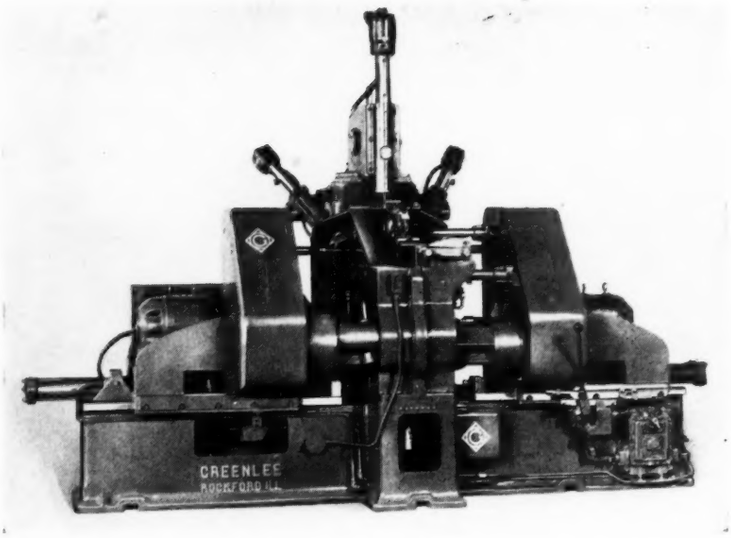


Fig. 2. General View of the Seven-way Drilling, Sawing, and Grooving Machine Designed for Machining Packard Pistons

After the drum has been indexed to bring two pistons to the second station, the multiple-spindle heads on the opposite ends of the bed, as seen in Fig. 2, are advanced hydraulically for core-drilling both wrist-pin holes of the piston in position *A*, Fig. 1, of the fixture. At the same time two circular saws, about 4 inches in diameter, mounted on the same heads, cut 3/64-inch wide slots under the No. 3 ring land of the piston in position *B* of the fixture.

At the third station, a lock-wire groove is recessed in both wrist-pin holes of the piston in position *A* by a small recessing tool mounted on the corresponding multiple-spindle head at the front of the machine. Also, the vertical unit at the rear of the machine drills a 5/16-inch hole in the skirt of this piston.

At the same time, an angular slot, 3/64 inch wide, is cut in the skirt of the piston in position *B* of the fixture by a saw that is mounted on the right-hand head, and four holes of 1/8 inch diameter are drilled at an angle through the wrist-pin bosses of this piston. These holes are produced by individually motor-driven heads at the rear of the machine. Two of these heads may be seen in Figs. 1 and 2, and there are two similar heads at the bottom of the machine which drill upward at the required angles. These angular heads and the vertical head all derive their feeding and return movements through rack-and-pinion mechanisms that are actuated by the right-hand slide on the bed.

Each piston must, of course, pass around the machine twice, once in position *A* of one of the fixtures and then in position *B*. Thus one piston is completed at each indexing of the drum. The left-hand slide on the bed is independently adjustable with respect to the right-hand slide. Adjustable stop-dogs control the rapid approach, feeding movement, and return of these slides, their operation being entirely automatic, except for starting. The length of the rapid approach and feed is adjustable within the dimensions of the hydraulic cylinders that actuate the slides. Pressure for both cylinders is developed by a pump at the right-hand end of the bed. The two slides are mechanically interlocked, so that their movements terminate at the same time.

Present Methods May Not be the Best

IN an address before the recent annual meeting of the American Gear Manufacturers' Association, N. M. Du Chemin, assistant manager of the West Lynn Works of the General Electric Co., called attention to the importance of studying methods used in the plant. "No matter what incentive wage plan may be used," said Mr. Du Chemin, "methods determine costs. Therefore, we are wise to enlist as much thought and cooperation as possible in our efforts to produce at lower costs in spite of increased rates of pay to labor, thereby insuring the continuity of our business at a satisfactory profit.

"It is imperative that industry attack the problem of improved methods with the same earnestness that we apply to wage incentives. We should no more leave it to the foreman to develop his own methods, as an addition to his multitude of other duties, than to ask him to do the time study work on which our incentive systems are based. 'Methods specialists' are as essential as 'time study men' —probably more essential.

"The development of 'methods men' is a process that calls for as much attention as the training of foremen; there is no supply of this talent at present, and a thorough knowledge of the plant's product and facilities is necessary before a man can make worthwhile contributions. It has been our experience that the average 'methods man' contributes in annual savings about five times his annual pay.

"From a plant personnel point of view, as well as for the convenience of the 'methods men,' it is desirable that the methods room be a restricted area—somewhat in the nature of a laboratory—in which processes may be perfected and accurate estimates of anticipated costs established.

"In selecting our personnel for this work, we have tried to acquire variety in the education and training of the men. We have mixed skilled mechanics, such as toolmakers and diemakers, with mechanical and electrical engineering college graduates, and we have even added a mixture of nationalities to our talent."

Another subject referred to by Mr. Du Chemin was that of operation surveys. "The company has prepared a questionnaire which is issued to every foreman once a week, asking about twenty questions relative to some specific operation and covering the qualifications of the operator, the character of the tools and fixtures, the material used, costs, and safety. The foreman is asked to select any operation within the scope of his observation, and to analyze the operation by answering the various questions on the form as they apply to the operation selected. The foreman has complete freedom to choose any operation. His analysis may show that the operation is satisfactory, but generally such 'surveys' have disclosed deficiencies from some angle, and we have had many recommendations for improvements.

"In the last six months of last year, approximately 100 foremen contributed annual savings of about $52,000; the present rate of return for 1937 indicates an annual rate of saving of some $112,000. Some foremen's contributions will exceed savings of more than $5000 per year, those of others will amount to only a few hundred dollars. Aside from the monetary advantage of these 'operation surveys,' we think we have two collateral benefits: (1) A rating of the foremen on this particular phase of foremanship; (2) an educational program that is teaching the foreman to appraise systematically with a critical eye every operation that comes under his jurisdiction."

* * *

Railroads Acquire Much New Rolling Stock

The railroads of the United States installed during the first six months of this year more new rolling stock than in any corresponding period since 1930. This new equipment included 166 steam locomotives, 20 electric and Diesel locomotives, and 34,187 freight cars. In addition, there were 42,624 freight cars on order on July 1, the greatest number for any corresponding date since 1924. There were also on order 301 steam locomotives and 33 electric and Diesel locomotives.

* * *

In 1912, a New York concern introduced steel-studded chrome-leather "over-shoes" for automobile tires. In pushing the product, the firm stated that the true function of pneumatic tires is to hold air and that "they should not, therefore, be compelled to endure road wear in addition."

Unemployment Insurance

Are Present Methods in the Right Direction?

There are Serious Doubts as to the Practicability of that Part of the Social Security Act that Relates to Unemployment Insurance. The Present Article Re-Emphasizes the Need for Industry to Take Constructive Action for the Enactment of Legislation Placing Unemployment on a Sounder Basis

By JAMES W. HOOK, President
The Geometric Tool Co., New Haven, Conn.

IT is nearly six years ago that several men at the head of industrial concerns began to give serious thought to methods that would take care of the unemployed during periods of severe industrial depressions. Industry as a whole, at that time, was asked to set its house in order, to make provisions for reserves for the purpose of maintaining a reasonable income for its stable workers during periods of unemployment, and to anticipate government action by fulfilling a duty that industry—were it willing to do so—could better take care of than governmental agencies. Unfortunately, industry did not respond to the proposals made, with the result that today federal legislation is upon us in a form complicated and costly in the extreme, and doubtful in its effectiveness.

In an introduction to an article by the writer published in November, 1931, MACHINERY, entitled "Promoting Permanent Prosperity," the editor of MACHINERY said: "Here we have a plan which, if adopted generally, would place industry in a position to do voluntarily and efficiently what otherwise, according to all indications, our National Government will undertake to do in a manner that experience abroad has proved to be unsatisfactory and inefficient." In July, 1932, an editorial in the same publication said: "The wisdom of industry in preparing for itself a well defined plan of action, rather than waiting for what might be ill-considered legislation, is unquestioned."

But industry waited. It accepted none of the comprehensive plans that were offered at the time, and, as a result, we have today legislation that places a heavy burden both upon industry and upon the worker. By taxing everybody alike—the employer who provides almost continuous, steady employment and the business that offers only temporary occupation—the present unemployment insurance provisions do not encourage good management in maintaining balanced production, but rather offer a premium to the careless, inefficient and unscrupulous employer, by offering to care for employes that he no longer needs.

The plans proposed six years ago by some industrial leaders would, if they had been voluntarily accepted by industry at that time, have had an opposite effect. They would have placed a premium on good management, since concerns that could keep their level of production reasonably even over the years would have been required to pay less than those less well managed as regards balanced production. Under the plans then proposed, the well managed concern or industry would not have been penalized by being asked to pay taxes to maintain a general national unemployment insurance, the need for which would largely be caused by the methods of management of industries or concerns that frequently lay off large numbers of their help.

Basic Principles of an Industrial Unemployment Insurance Plan

The plan that the writer proposed in 1931 and that it seems to him is still applicable to American industry is briefly outlined in the following.

This plan is based upon the principle that the unemployed may be grouped into three classes—the unemployable, the casual and nomadic workers, and the permanent or stable employes.

1. The unemployable must be cared for by charity as at present.

2. The casual and nomadic workers must be provided for during periods of unemployment crisis and depressions by work relief supplied by public works planned well in advance.

3. The permanent or stable employes should be assisted by their employer through the medium of reserves set up by each individual firm during prior years and used during periods of low employment to maintain a reasonable portion of normal income for those falling within this classification, and for paying dismissal wages to those who are dropped entirely from the payroll. The plan would provide for the setting aside of like percentages of reserves on the part of all employers in given industry groups, so that all would be on an equal basis.

What Proportion of the Unemployed Belong to Each Class?

While accurate statistics are not available, there are good reasons to believe that, during the depression, approximately 25 per cent of those classed as unemployed were unemployable. Thirty-five per cent belonged to the unstable or nomadic workers—men and women who do not want continuous employment; who desire to work in one place in winter and in another place in summer; and who like to flit about from place to place and from job to job. Many of them are casual laborers engaged in construction work in the cities, on road building, and on farms. Most of these people even at the present time are taken care of by the various government work relief projects, in spite of the fact that there is no longer any depression.

The remaining 40 per cent of the unemployed at the depth of the depression were the stable employes—men and women who are settled in their habits and want steady work; who are raising families and are building homes; and who have established positions in the community and standards of living that they desire above all things to maintain. This group is absolutely essential to the success of industry in normal times. It is a serious matter to them, to industry, and to the community in which they live when they are thrown out of employment. The larger percentage of this group is now employed again, since industry employs at present an even larger number of people, according to the most recent statistics, than during the 1929 period. It is this group to which industry itself has a responsibility.

I wish to reiterate a question that I asked six years ago: Will any forward-looking executive deny that he owes a responsibility to the stable force of workers in his employ? They are by all odds the most important single factor contributing to the success of any industry. Once the principle of an obligation to stable workers is accepted, specific plans to discharge the obligation would be a matter of conferences in the different industries, the government's part being simply to see that such conferences are held, and that the provisions for unemployment insurance within each group would agree in principle with the legal requirements that should be laid down as a guidance. These requirements would also provide for a minimum of the obligations to be fulfilled by industry, while any group would be free to adopt a more liberal policy should it so decide. Had some such voluntary plan, evolved and accepted by industry itself, been put into effect five or six years ago, we would not now be faced by a cumbersome, inefficient, and inequitable law providing for universal government unemployment insurance.

Details of the Plan Proposed Briefly Outlined

A complete outline of the plan that the writer has had in mind was given in an address before the American Society of Mechanical Engineers, December 2, 1931. Briefly, this plan would include the following provisions:

1. Every community should have means for administering funds provided for charity to take care of the unemployable.

2. Each community with a population of 5000 or more should have a public planning board made up of public officials and private citizens to plan, in advance, necessary and useful work for the community, where the casual and nomadic workers would find employment during periods of depression. It is preferable that such public work be handled by individual communities rather than by states or federal government. There is likely to be less politics involved when the work is handled locally, the supervision is likely to be better, and the waste less. Except in direst need, the state and federal governments need not take cognizance of either the first or second group here referred to. Local charity and local public work administration is better fitted to do this work well. The federal government should not be in the charity business except as a last resort; and even then the funds supplied should be administered by local bodies, under definitely formulated rules.

3. Every employer of labor should be required by proper legislation to set up unemployment reserves for his own permanent or stable employes. From this fund would be paid unemployment benefits during periods of depression and dismissal wages during any period.

Who are the permanent or stable employes? That, each branch of industry should determine for itself. As a general proposition, they are the employes, including both salaried men and women and wage-earners, who have been on the payroll continuously for a year or more. Provisions should also be made to include other employes who have been steady residents of the community for, say, two years or more, and who have been steady workers during the entire time in not more than, say, three places, and who have not been dismissed from any occupation for bad conduct. To be a stable employe would under these conditions become a distinction worth trying for; but the requirements for attaining and maintaining this position should be such that they do not impair the individual's freedom to better himself.

Each Business Creates its Own Unemployment Reserves

Each business would set up an unemployment reserve. Actual experience during the present depression has proved that the amount set aside for this reserve need not, in any reasonably well managed business, be anywhere nearly as large a percentage of the annual payroll as the present Social Security Act requirements for unemployment insurance. This reserve should be placed in trust, and would be drawn upon only for the purposes for which it had been set up.

In order that some basis for the size of these reserves may be arrived at, the reserves should be

based on the theory that a major depression might occur once in every seven years. Each company would set aside a certain percentage of its payroll for this reserve annually; but when, for any business, the reserve had reached a certain amount, the employer should not be required to continue payment into it. In this way, the employer who had been able to maintain steady employment for his force would be encouraged to do so, by being relieved from the payment or tax which in his individual business would be no longer required. As soon as the fund fell below a certain minimum, payments into it would, of course, be resumed.

Another method to encourage stabilization of employment and to accommodate cases where, for any cause, the number of employes in a certain unit of business might decline, would be a provision for the privilege of withdrawing excesses of accumulation from the reserve fund. An application, with all supporting facts, should be made to a committee of the industry of which the applicant is a part, which, in turn, should report its recommendation to the governmental authority that might be set up as an umpire merely to see that the law was being properly observed by industry.

It is not contemplated that there would be a centralization of these reserves. Each employer would be required to provide the reserve for his own business alone, the same as he now provides for his own individual tax reserves—the only difference being that the unemployment reserve should be placed in trust.

The decentralization of these funds would have many important advantages. First, of course, it would provide a strong incentive for each employer to minimize unemployment in his own business, in order to justify a request for a reduction in the reserve requirements; and, second, it would tend to spread reserves over a wide field and among many banks, thus simplifying the problem of liquidation when unemployment benefits were to be paid.

Should the Employes Contribute to the Reserve Fund?

The question frequently arises, "Who shall contribute to the reserve fund?" Many think that contributions should come from both employers and employes. This would make the employe realize his obligation and render him more cautious in demanding increased benefits and in wielding group political pressure. From a dollar-and-cents standpoint, however, it actually makes little difference whether one or both pay, because industry —employers and workers alike—must ultimately pay the bill, and will pass it along to its customers, if it is to survive. It would greatly simplify the procedure if employe participation were omitted, since it would obviate the necessity of shifting funds when an employe who had been contributing quit work or left to become employed by another company.

The present proposal has dealt with unemployment insurance only, since possibly the present provisions of the Social Security Act for old-age retirement benefits are as satisfactory as if the matter were handled directly by industry. Many problems involved in the earlier industry plans for old-age pensions are avoided when this part of the Social Security Program is on a national basis. Furthermore, there does not seem to be the same objection to the old-age benefits as to the present unemployment benefits. What is needed most is the encouragement that the plan just outlined would give to individual employers in providing stable employment.

It may seem too late for industry to reopen the subject and urge a reconsideration of the Social Security Act in so far as it relates to unemployment; but certainly, if we have made a national mistake, it is not too late to try to correct it. Those engaged in industry—employers and workers alike —being largely dissatisfied with the burden placed upon them in the form of taxes for unemployment benefits, have good reason for proposing a constructive program. It is not enough to find fault with things done by the Government; it is necessary to propose and support an alternative plan that can be shown to have worthwhile advantages.

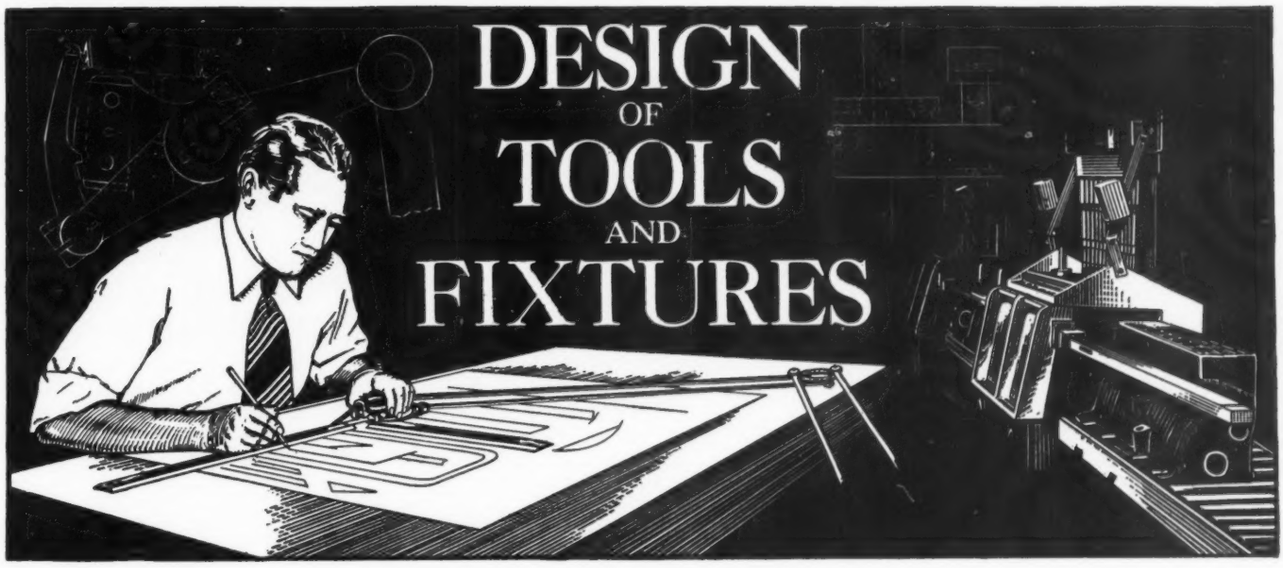
* * *

Chicago Exposition of Power and Mechanical Engineering

From present indications it appears that the Chicago Power Show, to be held in the New International Amphitheater, Chicago, Ill., October 4 to 9, will be the largest show of its kind ever held in the midwest area. A very large number of well-known manufacturers have reserved space. Among these are steel manufacturers, makers of power plant piping, and non-ferrous metal producers. Tubing will be especially featured. In the machinery field, there will be among other machines, automatic saw filers and saw grinders, and a combination metal sawing, filing, and polishing machine. One exhibitor will feature metal stampings produced at very low die cost, so that small lots of stampings can be produced economically. Manufacturers of equipment for shop transportation and materials handling will have large displays, including portable elevators, industrial tractors, trucks, and trailers.

* * *

It is mentioned in the Binghamton *Sun* that five hundred bills have been introduced recently in various legislative bodies throughout the country which would add about one billion dollars annually to the cost of operating American railroads. Fortunately most of these bills will probably not be passed. Nevertheless, it is a sad commentary on our law-making bodies that instead of assisting so important a branch of our national activities as the railroads, our legislators are mainly intent on how to harass them by additional taxes.

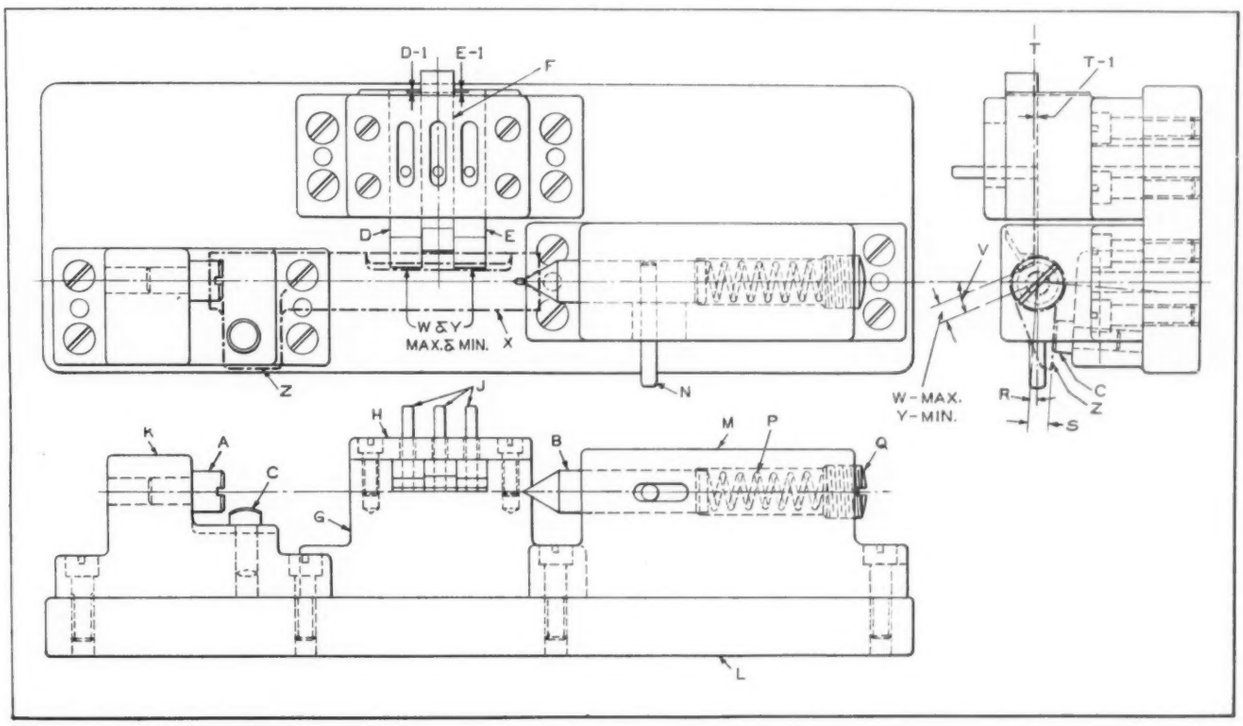


Gage for Checking Depth and Location of Spline

By F. SCRIBER

The gage shown in the accompanying illustration is designed for checking the accuracy of the radial location and depth of a groove or slot in the part *X*. The gage is designed to center the work, position it at the proper angle, and make the tests necessary to determine the accuracy of the slot-milling operation by means of slides and gaging steps. Referring to the illustration, the work is placed over a centering member *A* which, in conjunction with the spring-actuated center *B*, supports the work while the lug *Z* is pressed down against the pin *C*. With the work in this position, the gage slides *D*, *E*, and *F*, at the rear of the base, are pushed forward into the gaging position.

The three gaging slides are mounted in a support *G*, in which they are retained by a plate *H*. Three pins *J* project through holes in the plate, one being used to operate each of the three gaging slides. There is also a block at *K* for holding the member *A* and locator *C* in position on the baseplate *L*. The center *B* is free to slide in the block *M*. The user of the gage pulls back on the pin *N* to withdraw the center *B*, which causes the spring *P*



Flush-pin Gage for Checking Depth and Location of Milled Groove in Piece X

to be compressed. The locating lug on the work is set at an angle *R*, with its face below the center a distance *S*. This setting provides a horizontal line at *T* which corresponds with the lower edge of the spline. The spline groove runs at an angle *V*, and its maximum depth *W* and minimum depth *Y* from the center of the work are gaged by *D* and *E*.

In using this gage, the slide *E* is first pushed forward, after which slide *D* is brought forward until both slides come against the bottom of the spline groove. The slides are ground on line *T*, so that they will pass over the maximum off-center position indicated as *T–1*, thus providing a maximum step gage in that direction. With slides *D* and *E* against the work as shown, the outer ends of both slides must come within the limit imposed by the steps at *D–1* and *E–1*, in order to pass inspection. This gaging operation checks the depth at both ends of the splined groove and thus controls the parallelism of the slot with the axis of the work.

The next operation is to bring the center slide *F* forward. This slide is so positioned and ground along the line *T–1* that it will not pass over the lower edge of the splined groove if the work is within the minimum off-center allowance. Although this process of gaging may appear to be rather complicated, in actual practice it is only necessary to place the work between the centers, hold it with the left hand against the locator *C*, and with the right hand, move the three gage slides *D*, *E*, and *F* forward, in order to do all the required gaging.

Floating or Equalizing Chuck Jaws for Work of Irregular Shape

By FRED HORNER, Bath, England

Chucks with compensating or equalizing jaws such as shown in Figs. 1 and 2 can be used successfully for holding irregular-shaped pieces that have wide variations in dimensions and that would be difficult or impossible to hold in chucks with ordinary jaws of the rigid type.

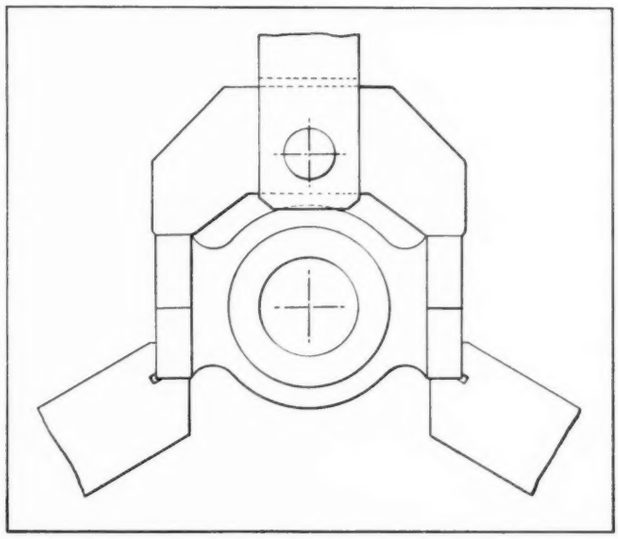


Fig. 1. Chuck with Two Formed Jaws and One Equalizing Jaw

The floating or compensating jaw arrangement shown in Fig. 1 provides an exceptionally effective method of holding work such as valve bodies. The views at *A*, *B*, and *C*, Fig. 2, show three applications of equalizing jaws to three different jobs.

Tapping Fixture for Thin Wing-Nuts

By H. GOLDBERG, Vice-President
R. G. Haskins Co., Chicago, Ill.

The tapping fixture shown in the accompanying illustration is designed to simplify the tapping of small parts, such as the thin wing-nut *W*. The front and both sides of the fixture are left open to facilitate tapping a variety of small parts that are or-

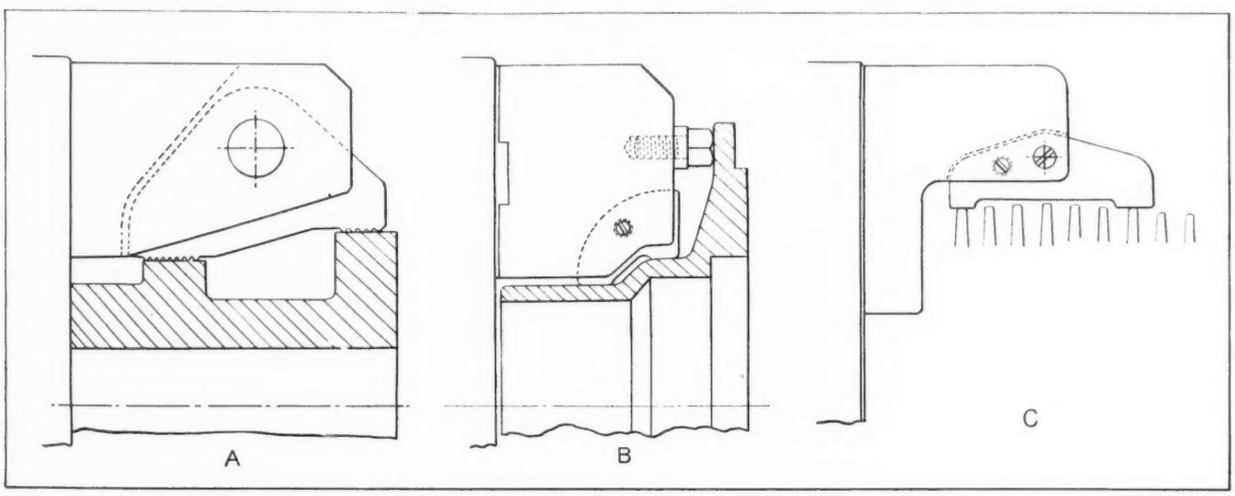
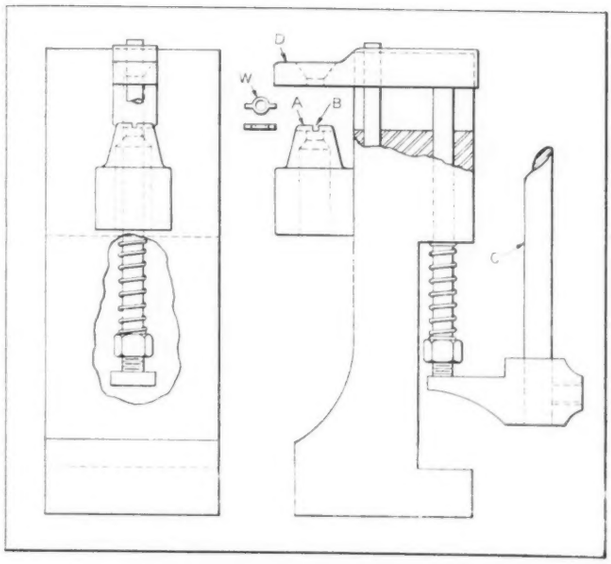


Fig. 2. Floating-jaw Chucks for Three Different Forms of Work



Tapping Fixture for Wing-nuts

dinarily difficult to handle. Usually the tapping of such parts takes less time than the handling.

The blank is placed on support *A* with the wings located in slot *B*. When the tapping pedal is depressed, the arm *C* fastened to the tapping head moves down, allowing the spring to draw the hold-down arm *D* down on the work and hold it in place while being tapped. Arm *D* also serves as a stripper when the tap reverses.

Radius-Forming Fixture for Grinding Wheels

By HECTOR J. CHAMBERLAND, Springfield, Mass.

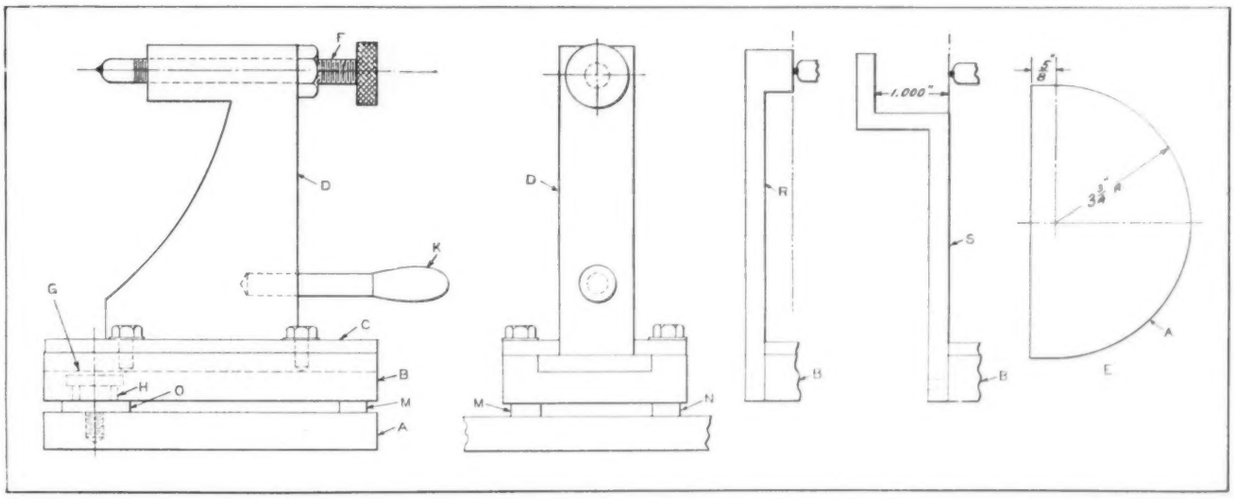
It is practically impossible today for any toolroom to do without some means for forming grinding wheels to a radius. Radius-formed wheels are used for form-grinding on surface, cutter, and even cylindrical grinding machines. Various improvised arrangements are employed for the radius-forming operation, some being good, while many are entirely impractical.

When several surface grinders are in operation or when considerable form-tool grinding is done, the expenditure of $125 or more for equipment for radius-forming the wheels is a good investment. On the other hand, there are many shops in which inexpensive but accurate means must be devised for forming the wheels to the required radii. The fixture shown in the accompanying illustration has proved to be a very satisfactory solution of the problem in plants of the latter type. This fixture has a range suitable for the average run of work, and can be made for less than $25. Concave or convex forming to a radius of 5/8 inch, which is sufficient for grinding wheels with face widths up to 1 1/4 inches, can be done on this fixture. Segmental forms within the two-way capacity of its adjustment can, of course, be produced.

Referring to the illustration, the base *A* is 1/2 inch thick and is semicircular, as indicated by view *E*. The oscillating member *B* has a three-point bearing on base *A*, consisting of two hardened steel supporting pads *M* and *N* at the rear and a hardened steel washer *O* at the forward end. This arrangement affords a very free pivoting or swinging movement through the manipulation of handle *K*. The radius-adjusting member *D* fits into a recess in member *B* and is held in place by two clamping bars *C*.

Settings are obtained with either plug gages or gage-blocks by the aid of the gages *R* and *S*, gage *R* being used for convex forms, and gage *S* for concave forms. Once adjustments have been made and a trial cut shows that the setting is not exactly right for the desired radius or segment, corrections can be made quickly by a slight movement of the diamond-holder *F* which has a fine thread.

The fixture shown is made of machinery steel, the only hardened parts being the three members *M*,



Fixture with Truing Diamond and Gages for Forming Grinding Wheels to Any Radius up to 5/8 Inch

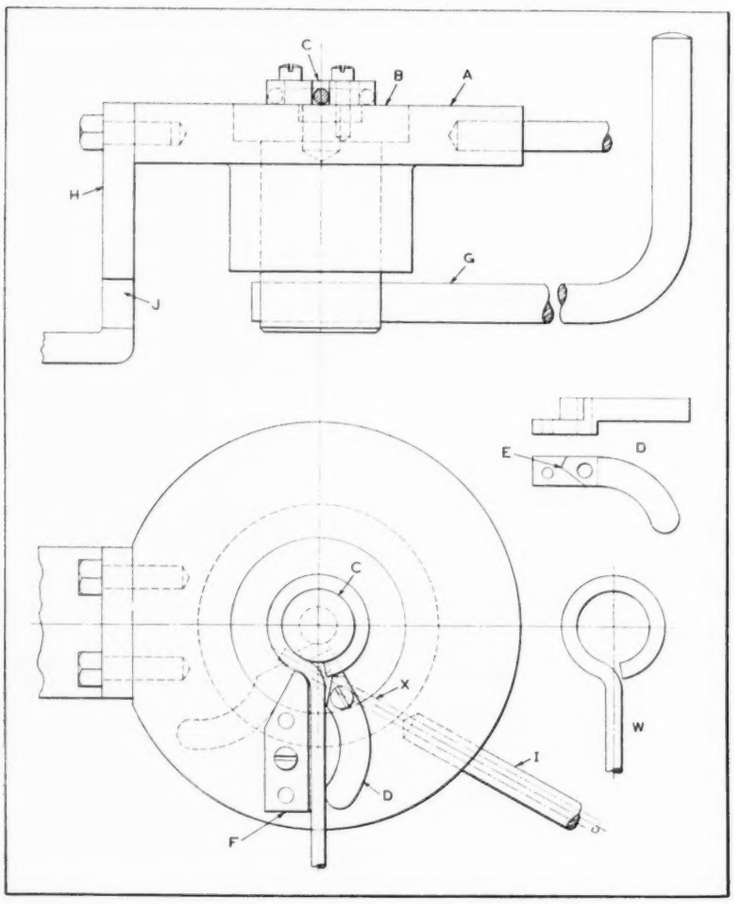
N, and *O* and the pivot stud *G* and bushing *H*, the latter being a press fit in member *B*. Washer *O* is free to turn and the bearing pads *M* and *N* are surface-ground after being fitted to member *B*. This grinding brings pads *M* and *N* to the same thickness as washer *O*.

Bending Fixture for Forming Eyes on Small Round Stock

By GEORGE WILSON, Marshalltown, Iowa

The simple hand-operated fixture shown in the accompanying illustration is designed for bending eyes like the one indicated at *W* on the ends of rods or round steel stock 1/4 inch or less in diameter. The cast-iron body *A* is bored to give a running fit for the steel plug *B* which, in turn, is bored to receive the mandrel *C*, around which the work is bent. Plug *B* is also channeled to receive the work-dog *D*, which is held in place by a screw and dowel. Body *A* carries the work guide *F*, which is secured to it by a screw and dowels. Guide *F* is hardened at the end that is in contact with the work.

The dog *D* is made with a sharp corner where it makes contact with the work. This corner of the dog is hardened. Mandrel *C* may also be hardened.



Fixture for Bending Eyes W on Ends of Small Rods

A work gage-rod *I* is threaded to fit a tapped hole in body *A* and carries an adjustable stop. However, this stop can be dispensed with, as an operator can easily locate the rod by eye so that 1/8 inch or less of the rod end projects past the gripping end *E* of dog *D*.

The bracket *H* can be attached to a bench or held in a vise. Notches are made in bracket *H* at *J* to permit lever *G* to be revolved through the arc required for the bending operation.

Members *F* and *D* are so mounted on *A* and *B* that the stock will pass freely between their ends and mandrel *C* when advanced to the position indicated by the dotted lines at *X*. The dog *D* is bent so that its outer end comes in contact with the work and completes the bending of the shank at the point where the formed eye meets the shank. The bent lever *G* is convenient for bending stock smaller than 1/4 inch in diameter. For 1/4-inch steel, however, which is about the maximum capacity of the fixture shown, the lever is left straight and has a length of 2 feet or more. A set-screw serves to hold the handle in place.

* * *

It is frequently said that the young men of the present generation are not willing to work so hard to achieve success as those of the generations preceding them. Commenting on this, the *Durez Molder* says: "This land is full of ambitious men and boys—boys who attend school, who work part time while studying, who take special courses in the evenings—all with a definite goal in mind. These boys will rise to the top and be the leaders of tomorrow. They know more of television, radio, and Diesel engines than their elders. They are workers. They know that in America a man stands on his own. They are not asking for a six-hour day. There isn't sufficient time to accomplish the things they dream of in twenty-four hours a day."

* * *

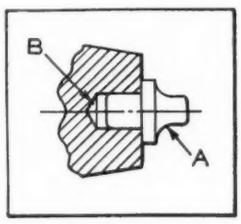
According to J. A. Brearly, chief clerk of the Patent Office, there are still many would-be inventors trying to invent perpetual motion machines. In fact, the Patent Office refuses, on an average, six of such "inventions" every week. Ever since the Patent Office was first started, it has received in great numbers these applications for patents on perpetual motion devices. As far back as 1813, a circular issued by the Patent Office ended with the statement: "Perpetual motion is therefore considered a perpetual notion, and ought never to be attempted until the sun rises in the west."

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Kink for Removing Parts Pressed into Blind Holes

The accompanying illustration shows a hardened and ground ball-bearing cone *A* pressed into a blind hole in a small wheel. To facilitate removal of the cone, a drop of water is placed in the reamed hole at *B* before the cone is pressed into place.



Part Forced from Blind Hole by Steam

To remove the cone for replacement, the wheel is simply heated to about 250 degrees F., thus converting the water into steam which forces the cone out. As the steam develops considerable energy, care must be taken to see that no one is in a position to be hit by the ejected part which might cause serious personal injury, because of its velocity.

Jersey City, N. J. WILLIAM A. FURST

How Four Snap Gages Were Saved from the Scrap Box

In making four gages like that shown in the accompanying illustration, the figure 3 of the dimension 21.230 on the drawing was mistaken for an 8. As a result, the gages were finished to the dimension 21.280 inches instead of 21.230 inches. The gages were for use in connection with the frame of a bookkeeping machine and were urgently needed. Nevertheless, the four gages, representing a loss of about $40, were thrown in the scrap box. Although the writer had nothing to do with this particular job, he had previously experienced similar trouble in another shop, in which the work had been salvaged, and accordingly offered to reclaim the gages.

This was accomplished satisfactorily in the following manner: Using a surface grinder equipped with a cut-off wheel having a 1/8-inch face, a section indicated by the dotted lines at *A* was cut out of each gage, lengthening the distance between the opposite faces of the gage by approximately 3/8 inch. Next four pieces *B* with allowances for grinding to a drive fit in the cut-out sections *A* were made up. Enough stock was allowed on the blanks at *C* to permit regrinding to the 21.230 dimension. The edges of the inserted blocks were beveled about 1/16 inch to facilitate soldering them in place. After being ground all over, the gages showed no signs of having been patched. The total cost for the reclaiming job was about $5.

Hartford, Conn. GEORGE DES CHENES

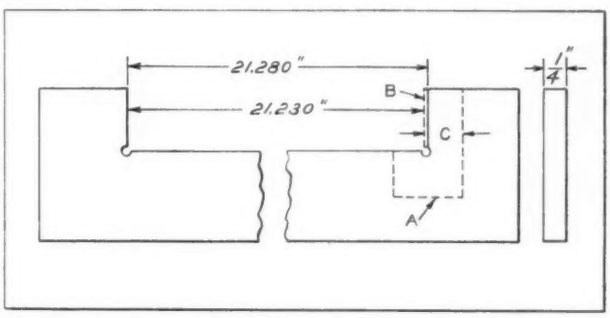
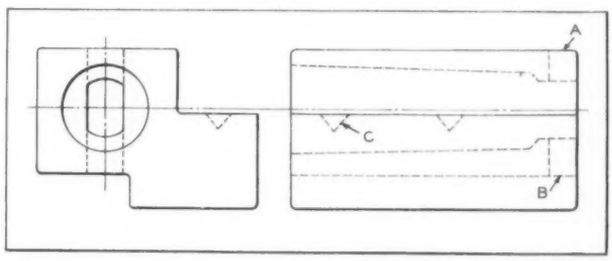


Diagram Showing Method of Reclaiming Snap Gage



Holder for Drills and Reamers which can be Mounted on the Turret or Cross-slide of a Lathe

Drill and Reamer Holder

The drill and reamer holder shown in the accompanying illustration can be held in an O. K. or similar combination tool-holder. It eliminates to a great extent the necessity of using the lathe tailstock, and thus avoids loss of time in adjusting the tailstock spindle. This holder is especially useful in drilling soft metals and plastics at high speed.

On production work, the saving in time resulting from the use of this holder is considerable. Drills, reamers, and counterbores can be quickly changed, and they can be correctly set by using the lathe stop or indicator. The particular holder illustrated is reamed to take a No. 4 Morse taper shank. The countersinks *C* are provided to facilitate setting up the tool. The block is slotted at *A* and *B* to receive the tang of a drill or reamer and to permit the quick changing of these tools. The holder can be easily made, and can be accurately drilled and reamed from the lathe headstock.

North East, Pa. LLOYD J. HERRIMAN

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Copyrights on Photographs and Advertising Matter

A. P. R.—Is it possible for another firm to obtain a copyright on photographs that we use for advertising purposes, if we fail to obtain a copyright? Can a trademark be used to protect advertising pamphlets? For how long a period do copyrights and trademarks run?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

No person has the legal right to claim authorship of a photograph owned by another. However, unless the original author copyrighted the photograph, he would not ordinarily have a legal right to sue and recover from the offending party, unless evidence is introduced showing that, by the false representation, the original author was damaged in some manner.

A trademark can be registered in the United States Patent Office. The applicant must take oath that previous to making the application his merchandise has been shipped or mailed from one state into another. In other words, interstate commerce is essential in obtaining a United States trademark. A trademark may consist of your name or any other mark which is original and not presently registered by another dealing in the same class of merchandise. Its term is for twenty-one years, and it may be renewed at the end of this period. The cost is nominal, and considering the protection afforded, it is essential.

A copyright is issued for twenty-eight years and may be renewed for another twenty-eight years. A patent cannot be renewed. A trademark will not prevent another from copying your advertising pamphlets, as only a copyright entitles you to sue for infringement.

Hardness of Lathe Beds

D. N. M.—Are any data available indicating how hard a lathe bed can be made and still be machineable? What Brinell or scleroscope reading should be obtained on a good lathe bed?

A.—The International Nickel Co. furnishes the following data: "Our records indicate that first-class engine lathes are made to a hardness on the ways of from 260 to 290 Brinell—or, expressed in terms of scleroscope hardness, from 36 to 38, occasionally as high as 40. The average in this range would be about 38. A scleroscope hardness of 40, or a Brinell hardness of approximately 300, represents the present limit of hardness for cast-iron machine tool ways. This is in answer to your inquirer's question as to how hard a lathe bed can be made and still be machineable.

"Actually, cast iron can be made with a hardness of approximately 400 Brinell, or a scleroscope hardness of 55, and be machined without grinding, although the machining rates at this hardness would be extremely slow. Roll makers are accustomed to handling their products at this hardness level and machining them without grinding. This comment should not indicate that a hardness of this order necessarily represents a desirable hardness for lathe beds under present manufacturing conditions, because other physical properties desirable in machine tools, particularly dimensional stability both during casting and after, become important production factors.

"Saddles and cross-slides, etc., are usually made to a scleroscope hardness from 4 to 6 points lower than the bed, so that their hardness will fall in the range of from 30 to 34 scleroscope, or from 180 to 220 Brinell.

"These machine tool castings are made of several compositions, some of which employ a cupola mixture of from 20 to 40 per cent steel, producing an iron of moderate strength, usually alloyed with from 1.00 to 1.50 per cent nickel and up to 0.30 or 0.40 per cent chromium, to obtain the desired hardness and uniformity of structure; others are made of a higher steel mixture containing from 40 to 80 per cent steel, and including from 1.00 to 1.50 per cent nickel, little or no chromium, and develop the desired hardness 'as cast' along with a high strength, high stiffness, and uniformity in structure throughout the varying sections.

"Another modification employs compositions similar to those given in the foregoing, cast against chills on the ways, or wearing surfaces, resulting in dense iron on these wearing surfaces and maintaining a fairly high proportion of very fine graphite flakes in which the hardness of the structure is somewhat further increased by the presence of the alloys. Usually a lower steel mixture is used in this case, and outside of the wearing surface, the iron is more open-grained and weaker than is the case with the other types."

* * *

It is less costly to learn by observation than by experience.

Assembling Camshaft Bushings in Cylinder Blocks

A HYDRAULICALLY operated machine is employed by the Packard Motor Car Co., Detroit, Mich., for the simultaneous assembly of four camshaft bushings in six-cylinder engine blocks or of five camshaft bushings in eight-cylinder blocks. This machine, as seen in Fig. 1, is provided with a table *A* which is supported on the vertical rams of four hydraulic cylinders, so that it can be lowered and raised with respect to four arms *B*. These arms are provided with mandrels at the upper ends on which the bushings to be assembled in the motor block are placed prior to the operation, as indicated at *C*. Arms *B* are attached to a hydraulic ram which can be operated horizontally under a high pressure.

When a cylinder block is slid into this machine from the roller conveyor on which it arrives, table *A* is in the raised position, as shown in Fig. 1. The block is located sidewise on the table between hardened and ground ways. Then a foot-treadle is depressed to open a valve, so as to lower the table and the cylinder block to the positions seen in Fig. 2. During this table movement, bracket *D*, Fig. 1, swings automatically in back of the cylinder block to support the far end of the block when pressure is exerted by the horizontal ram for assembling the bushings.

This ram is advanced automatically, after the table has reached the depressed position, to push the bushings into their seats in the cylinder block, which have previously been bored and reamed. The fit of the bushings in their seats is so close that when the ram is withdrawn, the bushings remain in the cylinder block. Table *A* is then automatically raised to the loading position again.

The horizontal ram is made with four arms *B* extending from one side and five similar arms extending from the other side. In assembling camshaft bushings into six-cylinder blocks, the four-arm side is upward, as illustrated. However, when eight-cylinder blocks reach the machine, the ram is indexed through 180 degrees to bring the five-arm side uppermost. It is then locked to hold the mandrels in the proper position for assembling the bushings in eight-cylinder blocks. This machine was built by the Oilgear Co., Milwaukee, Wis.

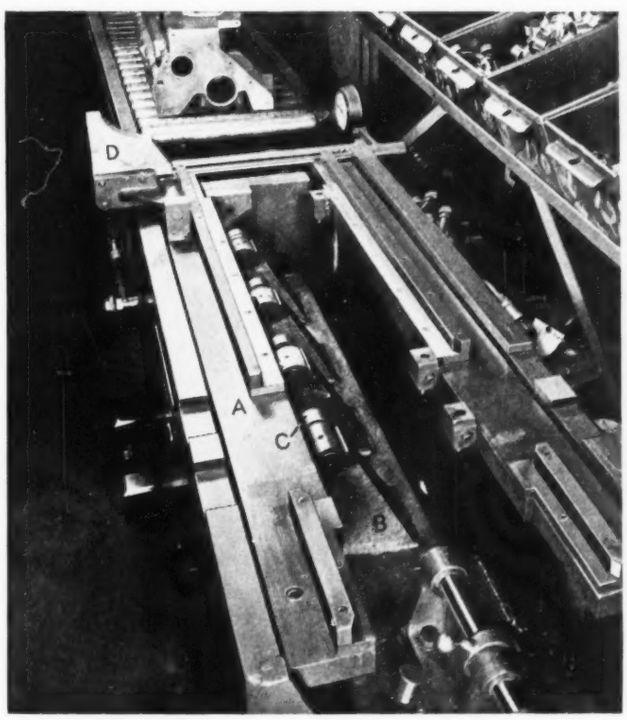


Fig. 1. Hydraulic Machine with Indexing Ram that Assembles Simultaneously Four or Five Camshaft Bushings in Six- or Eight-cylinder Engine Blocks

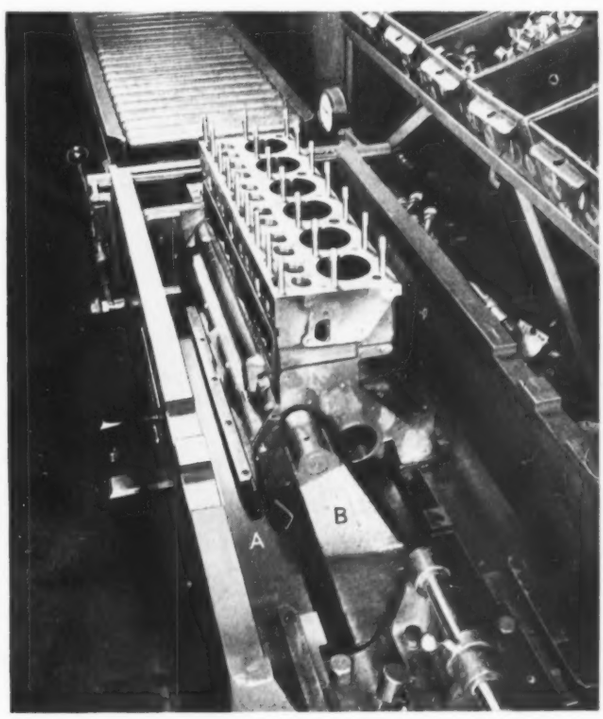
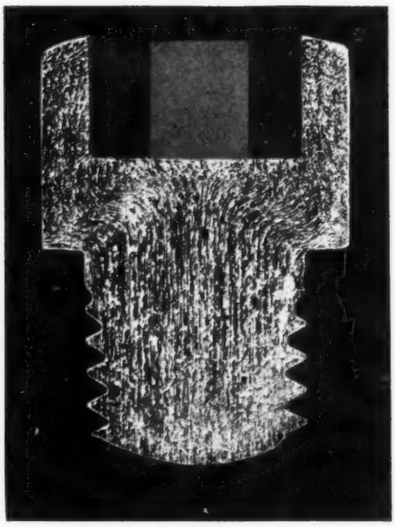


Fig. 2. View of the Camshaft Bushing Assembling Machine Shown in Fig. 1, with the Table in the Lower Position, Ready for an Operation

(Left) Complete Wrench Engagement and Greater Head Strength are the Results Aimed at by the Designers in Providing Flat Base Sockets in the New Parker-Kalon Socket Screws

(Right) The Cold-forged Process by which These Screws are Made Prevents, it is Claimed, Head Breakage and Other Structural Failures by Retaining the Unbroken Fibrous Structure of the Steel and Concentrating the Metal at the Points Subjected to the Most Severe Strain



New Line of Cold-Forged Socket Screws

BECAUSE of the constantly increasing demand for hollow set-screws and socket-head cap-screws, the Parker-Kalon Corporation, New York City, well known as pioneers in the development of fastening devices, over three years ago began to experiment with a view to determining what properties are most desirable in screws of this type, and what means should be employed in their manufacture to obtain these characteristics.

Before beginning to manufacture, a careful study was made to evaluate the various features of the screws and to set up certain standards that should be met by the new product. Then manufacturing was begun on a laboratory basis, an experimental plant being started to produce screws meeting certain definite requirements.

It soon developed that the equipment then available would not produce the kind of screw the designers had in mind, and the company's engineers, therefore, set about to develop entirely new methods and equipment. Again an experimental plant was installed on a small scale, consisting of special equipment. This plant, having been found to meet the requirements, was enlarged for regular manufacturing purposes and is now in operation, turning out a wide line of types and sizes of socket screws, including hollow set-screws, socket-head cap-screws, and socket-head stripper bolts, as well

Partial View of the Parker-Kalon Metallurgical and Mechanical Laboratory Showing Facilities for Maintaining and Controlling the Quality of the Corporation's Products

To Assure Uniformity of Physical and Metallurgical Properties, Each Size of Socket Screw is Subjected to an Individual Heat-treatment Routine, with the Laboratory Constantly Checking the Quality

as hexagon wrenches especially developed as an accessory to be used in conjunction with the screws.

Briefly, the important features embodied in these new products are as follows: The screws are cold-forged from a chrome-nickel alloy steel known as Parkaloy. The cold-forging process insures an unbroken fibrous structure and produces a concentration of the metal at the points subjected to the most strain. The bottom of the hole of the sockets is flat, permitting full wrench engagement, as well as ample strength at the base of the head in socket-head cap-screws and stripper bolts. The methods of manufacture further insure that the socket-head cap-screws seat properly in counterbores, because the heads are concentric with the body.

The threads provide a Class 3 fit in accordance with the standards of the National Screw Thread Commission. The method of cutting the threads and the heat-treatment produce a starting thread properly formed and free from burrs, thereby minimizing the possibility of "crossing" threads. The sockets are formed by an extrusion process which maintains the shape, size, depth, and central location within close tolerances. The methods of manufacture, in conjunction with a very thorough system of inspection, have resulted in a product for which definite claims are made for uniformity, accuracy, and strength.

In developing this product, the company was greatly aided by the fact that it possesses an unusually well equipped laboratory provided with modern means for making exacting chemical, metallurgical, and mechanical tests covering the analysis of the stock being used, heat-treatment methods, physical characteristics of the material, and tensile, shear, impact, and torque properties of the finished product.

Some of the exacting measuring instruments used for checking the master gages on which, in turn, depends the accuracy of the production gages have been developed and built by the company's own laboratory engineers, while the torsion, impact, and tensile strength testing machines are of the Olsen standard types. The heat-treatment, which assures uniformity of physical and metallurgical characteristics, is controlled by the aid of Leeds & Northrup Vapo-Carb furnaces in conjunction with Bausch & Lomb metallographic equipment. It will be readily understood that, to a large extent, it is the corporation's well equipped laboratory that stands back of this new line of socket screws.

* * *

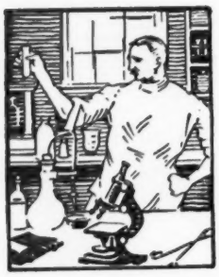
A Hot Weather Thought

When we ride in the cool, clean atmosphere of the modern air-conditioned train or when we sit in the cool, air-conditioned motion picture theater, with the temperature outside 95 or 100 degrees in the shade, it is of interest to contemplate the fact that only ten years ago these comforts were not available, and to visualize what the last decade has brought in terms of comfort and convenience, not only in this direction, but in so many other fields affecting our daily lives. It may also be worth while remembering in this connection that all of these engineering improvements that affect our daily lives have come about through the hard work of engineers and the courage, willingness to risk, and enterprise of industrial leaders. Not one step forward in all this progress was facilitated by any act of politicians, nor by the activities of men who are attempting to stir up strife and discontent among those engaged in productive work.

* * *

The James F. Lincoln Arc Welding Foundation calls attention to the fact that the new building code approved by New York City permits welded steel in place of riveted or bolted construction. This new code is hailed as an important step forward taken by the city government in reducing noise. The silent steel erection that can be obtained by means of welding has thus received the stamp of approval of the administration of America's largest city.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

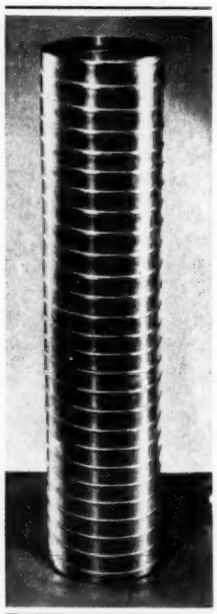
Plastic Molding Material for Large Housings

A molding material developed especially for radio cabinets and other large housings where appearance is important is the latest addition to the molding materials made by General Plastics, Inc., North Tonawanda, N. Y. This molding material has a deep rich black color and a smooth luster. It can be hard-buffed without showing filler spots. The material is known as "Durez 113 Black." . . 101

Thin-Walled Tubing Formed of Stainless Steel

Narrow strips of stainless steel only 0.012 inch thick are helically wound and lock-seamed together to form 6-inch diameter tubing, as shown in the illustration. This construction combines light weight with an unusually high degree of rigidity, according to the Electro Metallurgical Co., New York City.

The lock seams act as stiffeners and give both strength and rigidity to the tubing. The inside of the tube is quite smooth, as the locking seams are on the outer wall. One of the many potential applications of this tubing is for chimney flues when it is desired to protect the terra cotta linings from the corrosive action of flue gases. 102



Six-inch Tube of Stainless Steel 0.012 Inch Thick

Enamel with High Electrical Insulating Qualities

A new black enamel with unusual dielectric properties has been developed by the Maas & Waldstein Co., Newark, N. J. This dielectric enamel is especially suitable for electrical apparatus, such as steel switchboards and instrument panels. It dries to a rubber finish and is tough and durable. It is applied by spraying. The enamel has been applied to switchboards and buss boards in power plants in Los Angeles and in the Owens Valley system that brings power from Boulder Dam to Los Angeles. 103

Selecting Steel Shanks for Carbide Tools

In choosing the steel from which to make the shanks of carbide tools, consideration should be given, according to the Vanadium-Alloys Steel Co., North Chicago, Ill., first to the coefficient of expansion due to heating; second, to the expansion due to a structural change in the steel; third, to the hardness and toughness of the shank after brazing; and, fourth, to the weldability of the steel.

Since the coefficient of expansion due to heating is about the same below the critical point for all steels that would be satisfactory for this purpose, this point can be practically disregarded. At the critical point, however, steel undergoes expansion due to structural change. While it is impossible to prevent this change, the temperature at which it takes place can be controlled by the addition of manganese, silicon, or tungsten. It is desirable to have the change occur at a temperature sufficiently high so that the steel and brazing compound are plastic enough to give without permanent rupture.

On carbide tools intended for steel-cutting applications, the shank should be hard enough to resist "sinking" of the carbide tip. It has been found that a steel with a Rockwell hardness of from C-43 to C-48 after brazing is desirable. Carbide tools for machining cast iron or non-ferrous materials do not require a shank quite so hard, but the hardness should not be below Rockwell C-35.

Tools having a cross-section of less than 1/2 inch are likely to be too hard when cooled naturally from the temperatures ordinarily used in brazing,

To obtain additional information about materials described on this page, see lower part of page 40.

with the result that the tools break in operation. The Vanadium-Alloys Steel Co., therefore, recommends that tools with a cross-section less than 1/2 inch should be tempered after brazing. It is a known fact that brazing material sticks much better to certain steels than to others; the steel selected for the shanks of carbide tools should have this property of "weldability" to a satisfactory degree. 104

Improvements in Bronze Caused by Addition of Nickel

Although bronze is one of the oldest alloys and is one of the first forms in which man utilized metal, modern metallurgy has found means of improving this ancient material. Bronze is an alloy of copper and tin, but by adding nickel, it is possible to increase the strength, toughness, hardness, and corrosion resistance. The cost is also reduced, because of the fact that nickel replaces some of the tin, which is the most costly of the constituents. The addition of nickel makes it easier to fabricate bronze. 105

Huge Gears of Manganese-Molybdenum Cast Steel

Gears 16 feet in diameter, weighing 53,000 pounds each as cast, were recently produced by the Falk Corporation, Milwaukee, Wis., for transmitting the power of a 1500-horsepower motor in a rolling mill drive. The motor runs at speeds of 225 to 450 revolutions per minute. As recorded in *Moly Matrix*, published by the Climax Molybdenum Co., New York City, these gears were cast from "Telastic Moly," a manganese-molybdenum alloy containing from 0.15 to 0.20 per cent molybdenum.

The size and weight of the gears prohibited heat-treating operations that involved the use of quenching tanks; consequently, the heat-treatment consisted simply of annealing, normalizing, and drawing. This resulted in a tensile strength of 80,000 pounds per square inch, a yield point of 45,000 pounds per square inch, an elongation of 23 per cent in 2 inches, a reduction in area of 40 per cent, and a Brinell hardness of from 160 to 190.

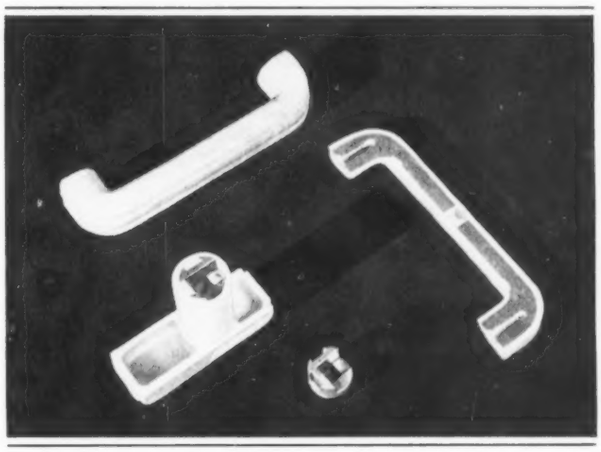
The same steel is also used by the Falk Corporation for smaller gears in a line of speed reducers ranging from 14 to 51 nominal horsepower. These gears are small enough to be liquid-quenched, the operation being performed in oil at a temperature between 1550 and 1600 degrees F. The gears are then drawn at 1250 degrees F., developing a tensile strength of 110,000 pounds per square inch, a yield point of 85,000 pounds per square inch, an elongation of 15 per cent in 2 inches, a 40 per cent reduction in area, and a Brinell hardness of between 210 and 245. 106

To obtain additional information about materials described on this page, see lower part of page 40.

Zinc Die-Castings Combined with Molded Plastic Parts

The advantages to be gained by combining die-castings and molded plastic parts were recently pointed out in an article appearing in the *New Jersey Zinc Alloy Pot*. With such a combined use, one material can supply qualities that the other material lacks. For example, the illustration shows two instances in which zinc die-castings are used as inserts in molded plastic handles. The plastic material is employed largely to obtain the desired color, and the die-casting to supply strength.

On the smaller of the two handles, which fits a cock on a gas stove, the plastic material is a translucent ivory. It is molded hot under high pressure in the same way as urea plastics of the same general type. The body portion or shank of the handle has a square hole with a thin wall that would readily split if it were not for the die-cast insert. Under-cut external splines prevent the insert from turning in the handle.



Combined Use of Molded Plastic Parts and Zinc Die-castings to Obtain Advantages of Both

The long handle consists of two die-cast inserts in cellulose-acetate plastic of a light mottled green color. The inserts have tapped holes which provide for fastening the handle to the drawers or containers of refrigerators. 107

Thicker Underlay of Nickel has Improved Chromium Plating

Chromium-plated parts on automobiles of former years had a tendency to scale off, that is not present, today. This improvement in chromium plating, according to the International Nickel Co., Inc., is due to the fact that the underneath coating of nickel is made considerably heavier, and not because of any change in the chromium. The nickel coating is, of course, much heavier than the outer chromium plate. Unsatisfactory plating is generally due to the use of too little nickel. 108

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 39 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in September Number of MACHINERY

Electrical Measuring Instruments

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Broadside N-33, descriptive of modern methods of temperature measurement and control and the instruments used, including Micromax thermo-couple pyrometers, resistance thermometers, optical pyrometers and Rayotube pyrometers, the latter applicable within a range of 300 to 5000 degrees F. 1

Lubricating Oils and Packings

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa., is distributing four bulletins, as follows: "Are Plant Surveys Profitable?"—the results of a lubrication survey made in a certain plant; "Off with the Old—On with the New"—some observations on modern group drives; "Modern V-Packings;" and "Bearing Metals and Lubrication." 2

Wear Testing Machine for Surface Finishes

TABER INSTRUMENT CO., North Tonawanda, N. Y. Bulletin 637, describing the construction and operation of the Taber Abraser, a precision testing machine for measuring the wear resistance, toughness, adhesion, and rub-off qualities of surface finishes, such as enamels, electroplate, molded plastic sheets, leather coverings, etc. 3

Switching Apparatus

GENERAL ELECTRIC CO., Schenectady, N. Y. Booklet 2605, comprising a pictorial guide to switching apparatus most frequently used. Illustrations of 137 different products are shown, together with a brief description of their application, rating, important features, and numbers of descriptive bulletins giving additional information. 4

Milling Cutters

INGERSOLL MILLING MACHINE CO., Rockford, Ill. Catalogue describing in detail the features of the Ingersoll Ray-Blade cutter, equipped with universal face milling cutter blades which can be used both for roughing and finishing. The bulletin also gives data and prices covering Ray-Blade end-mills, core drills and reamers, and cemented-carbide cutters. 5

Chain Drives

BOSTON GEAR WORKS, INC., Renold Division, North Quincy, Mass. Catalogue RD, listing complete chain drives available from stock. The catalogue is divided into three sections, the first devoted to Renold complete roller chain drives, the second to Renold chain drives with oil-bath chain cases, and the third to accessories. 6

Production and Inspection Tools and Gages

TAFT-PIERCE MFG. CO., Woonsocket, R. I. Book entitled "Handbook of the Taft-Peirce Mfg. Co.," containing 207 pages illustrating and describing the company's products, including gages, dial indicators, production and inspection tools, magnetic chucks, reamers, machine tools, and air service equipment. 7

Heat-Treating Equipment

AMERICAN MANGANESE STEEL CO. DIVISION OF THE AMERICAN BRAKE SHOE & FOUNDRY CO., 389 E. 14th St., Chicago Heights, Ill. Circular illustrating and describing the Hoffman Flexbox, a box made of Amsco alloy for use in heat-treating processes, with ends, sides, bottoms, and covers cast separately to prevent distortion or cracking. 8

Silent Chain Drives

MORSE CHAIN CO., Ithaca, N. Y. Bulletin 49, on Morse silent chain drives. The booklet contains engineering data, such as horsepower tables, methods of calculating chain length, lay-outs of typical shoes and idlers, and sprocket data, as well as information on applications of the different types of chain, directions for cutting sprockets, etc. 9

Bakelite

BAKELITE CORPORATION, 247 Park Ave., New York City. Booklet entitled "The Versatile Service of Bakelite Materials," outlining the development of various Bakelite resinous materials, their general characteristics, properties, and applications. 10

Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio. Application Sheet No. 56 in a series on the use of welding in machine design. This sheet deals with miscellaneous machine parts and shows how a wide variety of products can be designed and fabricated, using standard mill shapes. 11

Cutter and Radius Grinder

PRATT & WHITNEY DIVISION OF NILES-BEMENT-POND CO., Hartford, Conn. Circular S-455, illustrating and describing the mechanical features of the Keller cutter and radius grinder and its application on various classes of work. Complete specifications are included. 12

Nickel Cast Iron

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Bulletin dealing with the improvement of nickel alloy cast irons by heat-treatment. The information given covers critical ranges, critical cooling rate, stress relief, annealing, quenching, and air-hardening. 13

Pipe Fittings

BONNEY FORGE & TOOL WORKS, Allentown, Pa. Bulletin WT23, illustrating and describing WeldOlets and ThredOlets—drop-forged pipe fittings for making branch pipe connections by welding without the need of cutting, threading, or fitting of the main line. 14

Carbide Tool Grinders

EX-CELL-O CORPORATION, 1200 Oakman Blvd., Detroit, Mich. Catalogue CG-436, descriptive of three types of grinding machines for carbide tools. The catalogue also gives specific directions for rapid grinding technique, using these machines and vitrified wheels. 15

Molybdenum Iron

CLIMAX MOLYBDENUM CO., 500 Fifth Ave., New York City. Catalogue entitled "Molybdenum in Cast Iron," describing the improvements in cast iron made possible by the addition of molybdenum, and the applications of molybdenum alloy cast irons. 16

Flexible-Shaft Driven Power Tools

CHARLES L. JARVIS CO., Middletown, Conn. Catalogue MST, covering the Jarvis line of flexible-shaft driven power tools in bench and floor types, as well as in trolley and overhead saddle types for use where floor space is at a premium. 17

Indicating and Controlling Instruments

BRISTOL CO., Waterbury, Conn. Bulletin 490, covering the complete line of Metameter telemetering instruments made by this company for controlling pressure, liquid level, flow, temperature, mechanical motion, etc., from a remote point. .. 18

Power Transmission Pulleys

LINK-BELT CO., 307 N. Michigan Ave., Chicago, Ill. Illustrated price list No. 1622, covering cast-iron pulleys for power transmission, including solid and split, single- and multiple-arm, machine-molded pulleys with and without rubber lagging. 19

Stellite J-Metal

HAYNES STELLITE CO., Kokomo, Ind., Unit of Union Carbide and Carbon Corporation. New edition of a booklet entitled "Hard-Facing with Haynes Stellite Products," describing over 500 applications of the hard-facing process. There is a new section containing information on special Haynes Stellite J-metal cutting tools. 20

Overhead Material-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Circular G-437, describing some of the commonly used types of Cleveland cranes and transfer bridges, and illustrating typical applications. 21

Indicating and Recording Controllers

C. J. TAGLIABUE MFG. CO., Park and Nostrand Aves., Brooklyn, N. Y. Catalogue 1060C, containing complete data on Tag indicating and recording controllers for temperature and pressure. 22

Ball Bearings

BANTAM BEARINGS CORPORATION, South Bend, Ind. Bulletin 101, listing ball thrust bearings stocked in sizes from ½ inch to 3½ inches bore, and roller thrust bearings stocked in sizes from 6 to 12 inches outside diameter. 23

Flexible Lacquer Coatings

ROXALIN FLEXIBLE LACQUER CO., INC., Elizabeth, N. J. Circular describing the properties of a cellulose type air-drying flexible buffing lacquer. Circular descriptive of Blue Knight Ba-Flex flexible baking lacquer enamel. 24

Molybdenum-Tungsten High-Speed Steel

UNIVERSAL-CYCLOPS STEEL CORPORATION, Bridgeville, Pa. Booklet descriptive of MoTung, a molybdenum-tungsten high-speed steel, covering composition, working, heat-treatment, and uses. 25

Gas Furnace Safety Device

WHEELCO INSTRUMENTS CO., 1933 S. Halsted St., Chicago, Ill. Bulletin 1101, descriptive of the new Model 1101 Flame-otrol, a gas burner safety device designed to prevent explosion in gas-fired furnaces, boilers, etc. 26

Lubricating Equipment

GITS BROS. MFG. CO., 1858 S. Kilbourn Ave., Chicago, Ill. General cat-

---

To Obtain Copies of New Trade Literature

listed on pages 38-40 (without charge or obligation), check with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42

Name ..... *Position or Title* .....

Firm .....

Business Address .....

City ..... *State* .....

[SEE OTHER SIDE]

alogue covering the complete line of lubricating equipment made by this concern. Data is given on one thousand styles and sizes of oil-cups, oil and grease seals, oil-cans, gages, etc. 27

Carbide Tools and Blanks

VANADIUM-ALLOYS STEEL CO., Vascoloy-Ramet Division, North Chicago, Ill. Catalogue of carbide tools and blanks, containing useful data for toolmakers, including standard styles and reduced prices. 28

Heat-Treating Furnaces

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Booklet SC-82, illustrating and briefly describing a few typical heat-treating furnaces designed to meet specific problems in the automotive industry. 29

Power Squaring Shears

NIAGARA MACHINE & TOOL WORKS, 637 Northland Ave., Buffalo, N. Y. Bulletin HL, illustrating and describing the recently introduced Series HL Niagara power squaring shears, which are built in 6- to 12-foot cutting lengths with 10 gage capacity. 30

Electric Rectifiers

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Bulletin 1169-A, describing the construction and operation of mercury-arc power rectifiers for converting alternating current to direct current. 31

Tool Grinders

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Circular descriptive of Sundstrand tool grinders, designed for the accurate and economical grinding of cemented-carbide and other cutting tools. 32

Precision Drilling Machines

HIGH SPEED HAMMER CO., INC., 333 Norton St., Rochester, N. Y. Circular descriptive of the "High Speed" Model R-53 sensitive precision drilling machine having a capacity of 0 to 1/4 inch. 33

Test Indicators

FEDERAL PRODUCTS CORPORATION, 1144 Eddy St., Providence, R. I. Circular illustrating and describing the Federal Model 2 test indicator with universal holding bar, which is graduated to 0.0001 inch. 34

Silent Gears

CONTINENTAL DIAMOND FIBRE CO., Newark, Del. Bulletin on Celoron silent gears, covering standard forms and sizes, recommended practices for machining, horsepower rating, etc. 35

Hydraulic Equipment

TOMKINS-JOHNSON CO., 622 N. Mechanic St., Jackson, Mich. Catalogue H-37, covering the T-J line of hydraulic equipment, including hydraulic cylinders, power units, and special equipment. 36

Radius Grinding Attachment

CINCINNATI MILLING MACHINE CO., Cincinnati, Ohio. Circular M-768, descriptive of a new radius grinding attachment for the Cincinnati No. 2 cutter and tool grinder. 37

Electric Lathe Grinder

DUMORE CO., Racine, Wis. Bulletin illustrating and describing the new Dumore lathe grinder known as the "Chief," which is driven by a one-horsepower motor. 38

Electric Control Apparatus

ALLEN-BRADLEY CO., 1315 S. First St., Milwaukee, Wis. Circular illustrating typical applications of Allen-Bradley solenoid motor control. 39

Brazing Furnaces

FIRTH-STERLING STEEL CO., McKeesport, Pa. Catalogue illustrating and describing the Firth "Braze-Rite" furnace for brazing sintered-carbide tools. 40

Pumps

FAIRBANKS, MORSE & CO., 900 S. Wabash Ave., Chicago, Ill. Bulletin 6205, descriptive of Fairbanks-Morse steam pumps. 41

Shapers

GOULD & EBERHARDT, Newark, N. J. Bulletin 217, describing the new line of G & E tool-room and industrial shapers. 42

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 41-59 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, check with X in the squares below, the identifying number found at the end of each description on pages 41-59 — or write directly to the manufacturer, mentioning machine as described in September MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 36-37, check with X in the squares below, the identifying number found at end of each description on pages 36-37 — or write directly to the manufacturer, mentioning name of material as described in September MACHINERY.

101	102	103	104	105	106	107	108

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Barnes Vertical Honing Machine of Huge Size

Cylinders up to 30 inches in diameter by approximately 85 inches in length can be finished with the huge vertical honing machine here illustrated, which is probably the largest vertical machine for honing ever built. This machine measures 31 feet 4 inches from the floor to the extreme top, with the spindle in the uppermost position. Equipped with a hydraulic pump, motors, starters and filter, the machine has a weight of approximately 35,000 pounds.

Three machines of this type have recently been constructed by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. The particular operation illustrated in Fig. 2 consists of honing a Diesel engine sleeve having a bore 17 1/2 inches in diameter by 5 feet long. This machine has a vertical spindle travel of 90 inches.

The large aluminum reciprocating head, which carries a bronze driving gear inside, together with the spindle and the hydraulic piston, is supported by a patented air counterbalance at the top of the machine. The head is connected to this counterbalance by means of vertical rods. The counterbalance is of the same design as those on other vertical honing machines built by the concern, but it is of considerably larger dimensions. There is no waste of air in the operation of this counterbalance, because on the down stroke of the honing spindle, the limited amount of air in the cylinder is pushed back into the main line.

The head reciprocates on ball bearings that run on flat tracks in hardened vertical bars. The head operation is smooth and uniform, without shock at either end of the stroke.

The controls of the machine are concentrated on the left-hand side. A ladder is provided on this side for convenience in setting the stroke stops on the vertical control rod and also for reaching the volume regulator and the top of the machine. Eight quick changes of spindle speed are available through levers at the operator's position. There are three levers, one for controlling the back-gears and the other two for shifting to two speeds each, as on the standard Barnes transmission. The shifter forks are operated by means of chain drives, actuated by a shaft within telescopic tubing.

The upper motor on this machine is of 30 horsepower capacity, this motor being suitable for driving purposes in honing cylinders from 17 1/2 to 21 inches in diameter. Motors of greater capacity are supplied for larger work. The lower motor has a rating of 15 horsepower and drives a Vickers hydraulic pump. A small motor at the bottom of the column supplies a generous flow of coolant to the hone and work.

Although the spindle stroke on the machine shown is 90 inches, a shorter stroke and shorter column can be supplied to suit individual requirements. Other important specifications are as follows: Distance from center

Fig. 1. Barnes Honing Machine for Cylinders up to 30 Inches in Diameter by 85 Inches in Length

To obtain additional information on equipment described on this page, see lower part of page 40

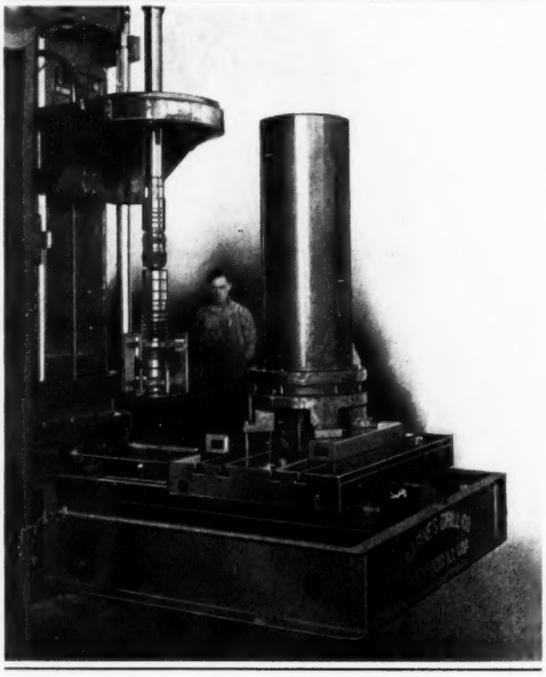
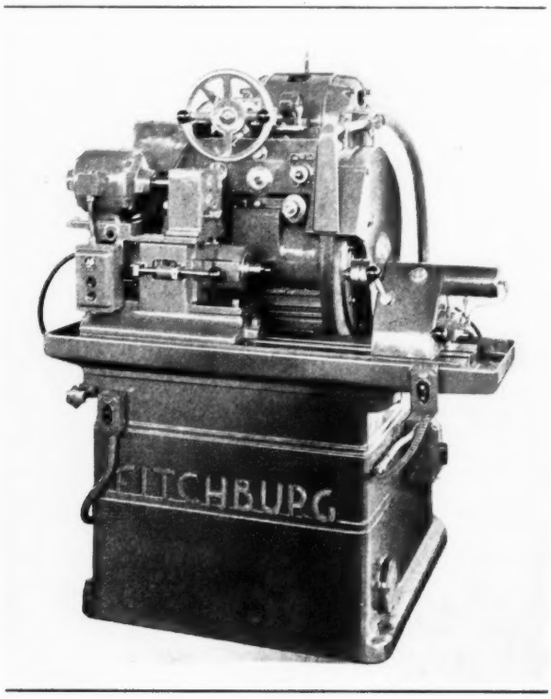


Fig. 2. Barnes Honing Machine with the Work-table in the Loading Position



Fitchburg Plunge-cut Cylindrical Grinder Designed to Occupy a Small Amount of Floor Space

of spindle to face of regular column, 20 inches; maximum distance from top of table to nose of flange spindle, 204 inches; dimensions of working surface on oil-actuated table, 40 by 60 inches; in-and-out travel of work-table on its tracks, 50 inches; and required floor space, 172 by 86 inches. 51

Fitchburg Plain Cylindrical Plunge-Cut Grinding Machine

Conservation of floor space was a primary consideration in designing the plunge-cut grinding machine here illustrated, which is a recent development of the Fitchburg Grinding Machine Corporation, Fitchburg, Mass. This machine occupies a floor space of only 38 inches in width by 48 inches in depth, although it has a capacity for swinging work between centers up to 14 inches in diameter by 12 inches in length.

This machine is built around a Bowgage wheel-head unit having a completely automatic cycle which is dial-controlled from the panel, as described in June MACHINERY, page 689. Headstocks can be furnished for either live- or dead-spindle operation and the complete cycle can be interlocked for operation by one lever. The machine can also be equipped with a retractable headstock center and a solid footstock.

There is no table traverse on this machine, but wheel-spindle reciprocation is provided. The grinding wheel is carried on the right-hand end of the spindle instead of on the left-hand end, as is customary. Considerable floor space is saved with this arrangement, because the wheel spindle occupies the same space longitudinally as the headstock. At the same time, the machine has the weight and wheel diameter to perform the work of larger machines.

Wheels up to 24 by 2 by 12 inches or 20 by 4 by 12 inches can be used. Several types of truing devices may be furnished.

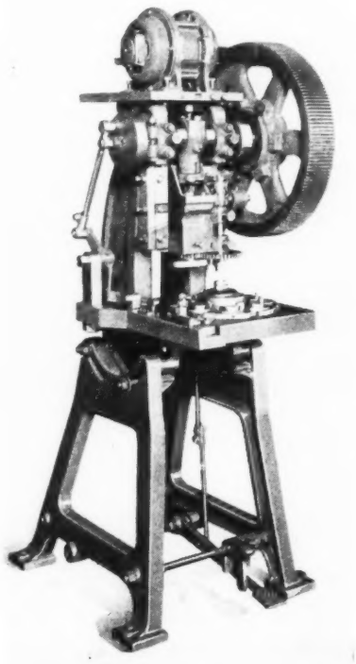
This machine is also built in a chucking grinder model, with a work-head that can be swiveled for taper grinding. 52

Greenerd 2- and 4-Ton Hydraulic Presses

Hydraulic presses of 2 and 4 tons capacity which are similar in appearance to the press illustrated in January, 1937, MACHINERY, on page 355, except for the table, have been added to the line of the Greenerd Arbor Press Co., Nashua, N. H. The motor and hydraulic pump are mounted on opposite sides of the main housing, and the pump is connected up between a 16-gallon sump in the base and a pair of hydraulic valves on the frame.

The ram is put in motion by operating a hand-lever. Pressure is applied on the work until this lever is released, at which time the ram automatically returns to a stop which may be set at any predetermined point within the stroke of the machine. The stroke is adjustable from 1 to 16 inches. The pressure can be regulated between 1/2 ton and full capacity. 53

To obtain additional information on equipment described on this page, see lower part of page 40.



Toledo Press Equipped for the High-speed Acid-etching of Steel Parts

Toledo Etching Press

The press here illustrated was recently built by the Toledo Machine & Tool Co., Division of the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio, for use in the acid-etching of small hardened steel parts. This machine is equipped with an eight-station dial that carries the work-pieces successively into position beneath a slide. Attached to this slide is a double rubber-stamp die which is rotated 180 degrees at each stroke of the press.

With the down stroke of the slide, the rubber stamp that is toward the back touches a pad of acid. Then on the next stroke, this stamp is rotated 180 degrees toward the front, so that it is applied to the piece of work that has been indexed under the die by the dial feed. At the same time, the rubber-stamp die that was toward the front on the previous stroke has been rotated toward the rear, so as to pick up more acid for the following impression.

With this arrangement, a piece of work is etched at each stroke of the press. The etched pieces are indexed to a point where they fall through a hole in the bolster and into a container. The machine is driven by a 1/2-H.P. motor, geared directly to the flywheel. 54

J & L Automatic Thread-Grinding Machine of Increased Capacity

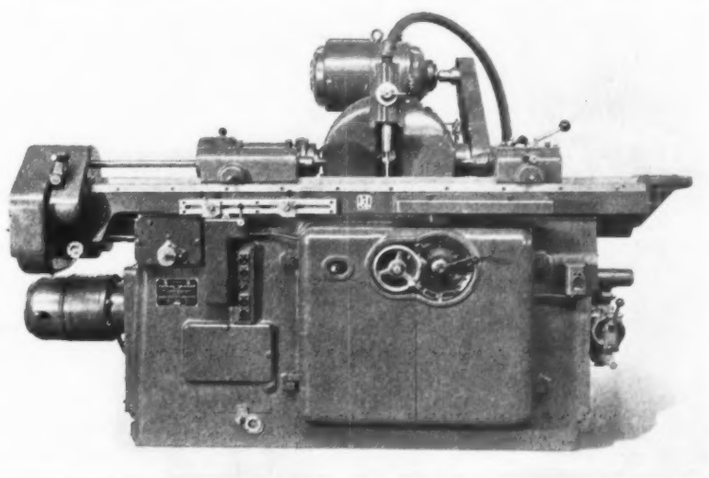
An automatic thread-grinding machine is being placed on the market by the Jones & Lamson Machine Co., Springfield, Vt., of similar appearance to the machine described in August, 1936, MACHINERY, page 807, but of substantially increased capacity. Threads can be ground with the new machine in hard or soft work up to 8 inches in diameter, using a 20-inch grinding wheel, and up to 11 1/2 inches in diameter with a 16 1/2-inch or smaller wheel. A 20-inch diameter wheel is regularly furnished.

Work 48 inches long can be held between centers, and 18-inch lengths of thread can be ground anywhere along 36 inches of the work length. The helix angle capacity of the new machine has been increased to include 25 degrees right-hand and 30 degrees left-hand. The helix angle setting is changed by means of a worm and worm-wheel.

Standard equipment includes change-gears for cutting threads from 2 to 48 per inch, inclusive. Single, double, triple, quadruple, and sextuple threads, of either right- or left-hand, can be ground. Also, by using a simple hardened and ground former, it is possible to grind taper, combined straight and taper, and double taper threads. The grinding wheel is always at right angles to the axis of the work, and therefore no adjustment of the thread form is required in changing from straight to taper threads. Also, lead compensations are unnecessary.

With the necessary attachments, the machine will grind button type hobs and circular chasers without lead, and will back off or relieve straight or taper hobs and straight- or spiral-fluted taps. A standard attachment can be furnished for grinding interrupted threads on taps.

An unusual feature is the provision made to insure proper speed of the grinding wheel for its work diameter. There is a scale attached to the truing de-



Automatic Thread-Grinder of Increased Capacity, Brought out by the Jones & Lamson Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 40.

vice which records the wheel diameter at all times, and a graduated rheostat is provided which has a pointer that indicates the number of spindle revolutions per minute. Knowing the wheel diameter and the spindle speed, the number of surface feet per minute at which the wheel is running can be determined from a chart on the wheel-slide. As the wheel is reduced in diameter, the proper speed can be readily maintained by simply turning the dial on the rheostat, which automatically compensates for the reduced size.

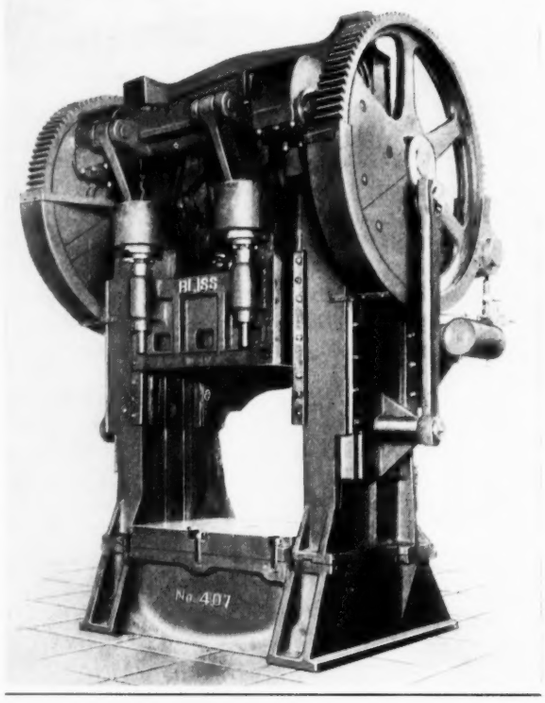
The self-truing, self-sizing mechanism with which the machine is equipped adapts it equally well for tool-room and production work. 55

Bliss Deep-Drawing Toggle Press

A double-crank, double-action, straight-sided toggle press designed especially for deep-drawing operations has recently been introduced on the market by the E. W. Bliss Co., 1420 Hastings St., Toledo, Ohio. This press has a plunger stroke of 21 inches and a blank-holder stroke of 14 inches. If desired, the machine can be converted into a triple-action press by the addition of Marquette drawing cushions in the bed.

The control is completely electric, push-buttons being provided for starting, stopping, and inching, the latter being especially advantageous in setting up dies. Another feature is a fully automatic air-operated combined friction clutch and brake. The clutch is mounted in the flywheel and the flywheel is mounted on Timken roller bearings. The press frame is constructed of four separate castings, held together by steel tie-rods that are shrunk in.

A 35-horsepower motor drives the flywheel through V-belts, the flywheel, in turn, driving through a double-geared twin drive train of gears. The shut height from the bed to the blank-holder, with the stroke down and the adjustment up, is 34 inches. The bolster is 6 inches thick, while the crankshaft is 7 inches in diameter at the bearings and 8 inches at the crankpins. 56



Bliss Toggle Press Designed for Deep-drawing Operations

Colonial 50-Ton Power Press

Two power presses of welded steel unit construction, 50 tons in capacity, were recently built by the Colonial Broach Co., Detroit, Mich. These presses were designed with a generous amount of clearance to facilitate the handling of large assembly work on the 36-inch square platen with which the machines are equipped. The machines are operated by hydraulic power, a pressure of 1000 pounds per square inch being developed by the pump. Each machine has a stroke of 18 inches. 57

Colonial Power Press for Automotive Assembling Operations

To obtain additional information on equipment described on this page, see lower part of page 40.

Sundstrand Tool Grinder

A two-wheel grinding machine for sharpening tools of tungsten carbide and other alloys has been brought out by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill., to supersede the three-wheel tool grinder previously built by the concern. This machine is constructed with two independent wheel-spindles, mounted on the same center line and equipped with anti-friction bearings. One of these spindles is fitted with a silicon-carbide cup-wheel for rough grinding, and the other with a diamond-faced wheel for finish grinding.

In rough grinding, the tool is clamped securely on the table seen at the left in Fig. 1, and passed across the face of the silicon-carbide wheel by imparting a rocking motion to the table support. This is accomplished by oscillating the handle at the right-hand end of the table support. A screw feed, actuated through the small capstan wheel on the front of the table support, is employed to advance the tool against the wheel with successive passes of the tool. Easy manual operation of both movements gives the operator complete sensitive control of the grinding.

In finish grinding, the operator places the tool against a protractor on the table seen at the right in Fig. 1, and advances the cutting edge to contact lightly with the fast-moving diamond-faced wheel. He then slides the tool and protractor back and forth as a unit under the guidance of a groove in the stationary finishing table. This gives a finger-tip control of the finishing operation and makes it practically impossible to take off too much material in one pass across the face of the wheel.

Positioning of the tool to the correct angles for finish grinding is accomplished by tilting the table and using the finely graduated protractor. The protractor has a vertical flat face, against which the tool is held during the grinding operation. A tongue on the under side of the protractor fits a central ground slot in the hardened table.

The fixture shown in Fig. 2 is provided for rough-grinding to top rake angles. It comprises an accurately graduated universal head with a capacity for holding tools up to 1 1/4 inches square, an oscillating unit, a feed-screw, and a base designed for clamping to the T-slot of the rough-grinding table. With the fixture set up as shown and a tool clamped at the correct angle, the operator turns the feed-screw by means of the knurled knob at the right until the tool touches the grinding wheel. He then swings

Fig. 1. Sundstrand Grinder for Sharpening Cutting Tools of Cemented Carbides and Other Alloys

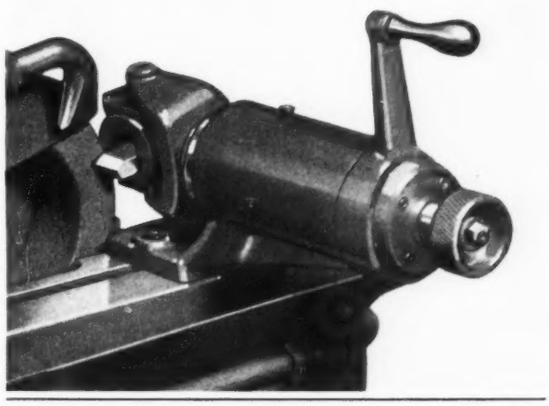


Fig. 2. Rough-grinding a Tool to the Top Rake Angle by Means of an Oscillated Universal Head

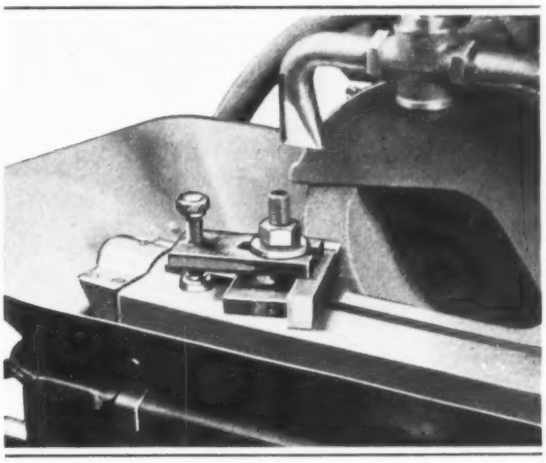


Fig. 3. Graduated Fixture Mounted on the Roughing Table for Grinding Front and Side Clearance Angles

To obtain additional information on equipment described on this page, see lower part of page 40.

the lever back and forth to sweep the tool across the face of the grinding wheel, feeding the tool in slightly between successive passes.

In rough-grinding front and side clearance, the table is adjusted to the desired angle above or below the horizontal, and the tool is held in place by means of the fixture shown in Fig. 3. This consists of a central member which fits the table T-slot, a graduated base, and a clamp. The hands of the operator are free to feed the tool in and sweep it across the grinding wheel face by oscillating the table.

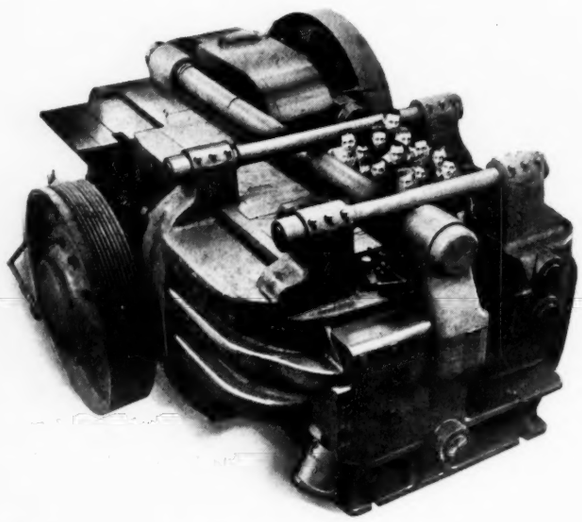
A fixture is also supplied for dressing the rough-grinding wheel, and another fixture is available for sharpening twist drills and countersinks up to 1/2 inch in diameter. The latter facilitates establishing correct cutting angles and maintaining cutting edges of equal length and suitable clearance. 58

Huge Forging Machines Built by the National Machinery Co.

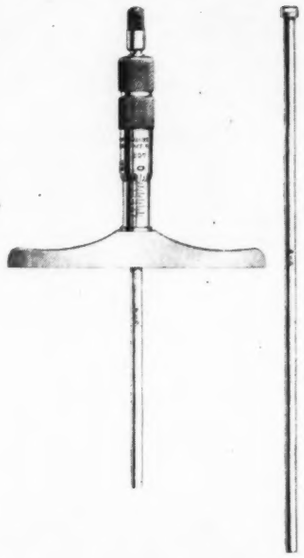
What are believed to be the world's largest forging machines have recently been built by the National Machinery Co., Tiffin, Ohio, for upsetting operations on tubing. Tubes as large as 14 inches in diameter can be handled. Two of these machines have been built, each weighing 500,000 pounds and requiring a 150-horsepower motor for driving purposes. The illustration shows one of these machines with twelve men standing in the die box space.

The machines follow the standard design of the company, being built with a heavy underslung bed frame, suspended overarm type heading and gripping slides, longitudinal and cross tie-bars for maximum rigidity, and an air-operated friction clutch. The bed frame had to be made in two sections, each of which was the maximum size that could be shipped. The bed members are held together by means of heavy tie-bars, which are shrunk in place.

A further impression of the size of these machines can be gained from the fact that the stroke of the heading ram is 30 inches. Gripping dies up to 52 inches in length are used. 59



Forging Machine Weighing Half a Million Pounds, which was Built by the National Machinery Co.



B & S Micrometer Depth Gage for Measurements from 3 to 9 Inches

Brown & Sharpe Micrometer Depth Gage

The micrometer depth gage No. 607 made by the Brown & Sharpe Mfg. Co., Providence, R. I., is now available in a size that measures depths from 3 to 9 inches, in addition to the previous size, which measures from 0 to 3 inches. The new size enables deep slots, holes, etc., to be measured to thousandths of an inch.

The micrometer screw has a movement of 1 inch, the range from 3 to 9 inches being obtained by the use of six measuring rods. These measuring rods are 3/16 inch in diameter, providing rigidity in long measurements, and the ends of the rods are hardened. The proper rod for a measurement is easily inserted in the gage through a hole in the micrometer screw.

Another feature of this depth gage is the positive seating arrangement provided for the interchangeable measuring rods. This design makes it possible for the gage to be furnished with a ratchet stop when desired. The base is about 4 inches wide by 9/16 inch thick, and is hardened. 60

To obtain additional information on equipment described on this page, see lower part of page 40.

Newton Unit-Head Box Type Milling Machines

The Newton Division of the Consolidated Machine Tool Corporation, Rochester, N. Y., has developed a line of unit-head box type milling machines which are designed with a view to providing single-purpose machines that can be converted at any time into machines capable of handling work other than that for which they were originally built. These machines are made up of several individual milling units and a planer type milling machine base.

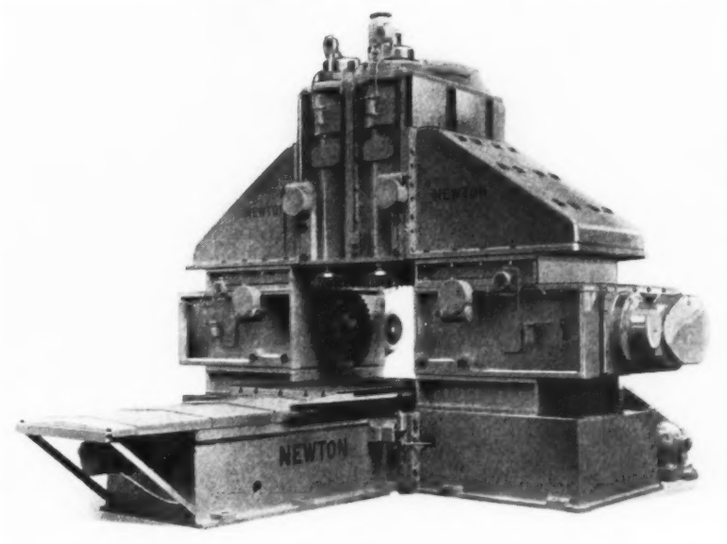
The machine illustrated has two horizontal head units, two vertical units, and an auxiliary vertical spindle that removes the stock left between the two large vertical cutters. Should this machine be required at some future time for work necessitating, say, four horizontal spindles, it can be easily arranged for such an operation by merely transposing the vertical heads and substituting a fill-in piece at the top. The unit heads could also be reset for use in horizontal, vertical, or angular positions.

The machine illustrated is arranged for milling the top, bottom, sides, and ends of tractor transmission cases in two operations. Each spindle head is an individual unit, having its own motor direct-connected through reduction and pick-off gears. Machines can also be furnished with quick-change gears or with a direct-current adjustable-speed motor.

Each spindle is provided with a separate end adjustment, and there is provision for locking the spindle quills. In addition, all heads can be repositioned along the holding flanges, being drilled with closely spaced bolt holes to allow for setting the heads in small increments closer to or farther away from the work.

The table is driven by hydraulic pressure. There is a single lever hand control of the feed and rapid traverse supplementary to an automatic control that is obtained through adjustable trip-dogs on the side of the table. Hydraulic screw- or cylinder-feeds, or a mechanical screw-feed can be supplied.

Another feature of the machine is an arm at the rear, which can be swung on its axis to facilitate attaching or removing cutters. 61



Newton Planer Type Milling Machine Constructed with Unit Heads

Machine Designed for Performing All Operations Required in Diemaking

Hack Universal Diemaking Machine

A machine designed for performing all the operations required in making dies has been brought out by Frank W. Hack, 440 N. Oakley Blvd., Chicago, Ill. Fifteen different cutting operations can be performed with the regular equipment, and this number of operations can be doubled by the use of auxiliary adapters.

Stripped of all removable units, the machine consists of a base, a compound table, and a reciprocating rear ram which is adjustable for stroke position. This ram can also be locked in a stationary position if desired. It is fitted with a master head to which other attachments can be fastened.

Incorporated in the head is a back-geared milling spindle, which is vertically adjustable within the ram, so that the machine is capable of performing the functions of a horizontal milling machine. The head can also be used as a lathe headstock.

The vertical head is easily attached. It can be rotated through a complete circle, and when vertical, affords eight speeds, four back-geared and four high speeds. Four speeds, all back-geared, are available in angular positions of the head. A sensi-

To obtain additional information on equipment described on this page, see lower part of page 40.

tive slotting attachment can be fastened on this head for performing filing, lapping, and other reciprocating operations at any angle. A hacksaw frame can be instantly attached to the master head and used interchangeably with an elevated table or with the center plate in the table top. A three-horsepower motor drives the ram, and a 3/4-horsepower motor, the master head. 62

Gisholt Improved Heavy-Duty Turret Lathes

Improvements intended to increase production, facilitate and speed up operation, and improve the quality of work have been incorporated in the 3AL, 4L, and 5L heavy-duty turret lathes built by the Gisholt Machine Co., 1209 E. Washington Ave., Madison, Wis. These improved turret lathes are available in three sizes ranging from 6 to 12 inches in bar capacity and from 21 to 32 inches in chucking capacity. The machines are intended both for the quantity production of similar pieces and the small-lot jobbing of varied types of work.

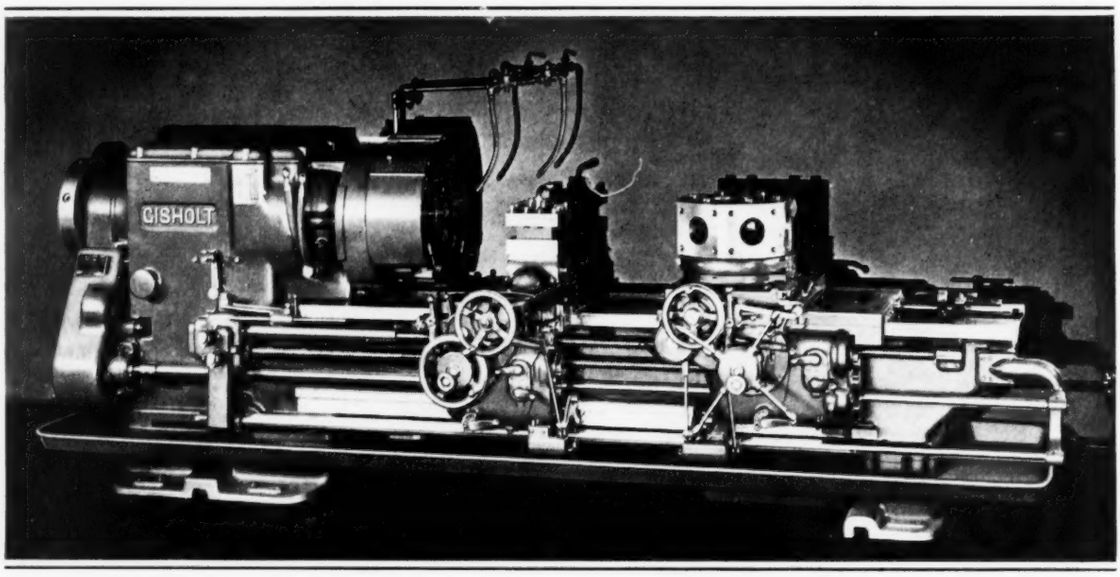
A new twelve-speed transmission of sliding gear construction provides a normal speed range of from 12 to 220 revolutions per minute for the 3AL model, and from 8 to 142 revolutions per minute for the 4L and 5L models. The spindle is mounted in twin tapered roller bearings at the front and in a straight roller bearing at the rear. An automatic multiple-disk brake stops the spindle quickly when the clutch lever is placed in the neutral position. This feature saves time in stopping to remove a piece from the chuck and holds the chuck stable during reloading.

The feeds and rapid traverse are controlled at each carriage, independently of each other. Eight reversible feeds are available at the aprons in arithmetical progression from 0.008 to 0.250 inch. With the change-gears provided, this feed range can be increased to include a fine range from 0.004 to 0.125 inch and a coarse range from 0.016 to 0.500 inch, thus providing a total of sixty-four feeds which permits the cutting of all United States standard threads from 2 to 32 per inch, including 11 1/2 per inch.

The power rapid traverse for each carriage is independent and can be used without disengaging the feed. An electrically operated rapid traverse can also be supplied for the cross-slide or the compound slide. A multiple V-belt drive from a motor on the headstock is standard equipment. Motors from 15 to 25 horsepower are provided for the 3AL turret lathe, and from 25 to 40 horsepower for the 4L and 5L models.

Either a fixed-center hexagon turret or cross-feeding turret can be supplied. The cross-feeding turret permits of facing, as well as turning and boring, with the hexagon turret. Lubrication is insured to all important bearings of these turret lathes by automatic methods. The headstock and apron gears run in oil baths, as well as the rapid traverse clutches and gears. The hardened and ground steel ways of the bed are lubricated by means of force-feed pumps attached to each carriage.

Available attachments include a compound slide with square turret, power- and hand-operated bar feeds, collet chucks for the 3AL model, turret centers for heavy work requiring an outer support, a selective speed gearbox for the feed-shaft in place of the pick-off gears, taper attachments for both the cross-slide and the hexagon turret carriages, and various chucks. 63



Improved Heavy-duty Turret Lathe Brought out in Three Sizes by the Gisholt Machine Co.

To obtain additional information on equipment described on this page, see lower part of page 40.

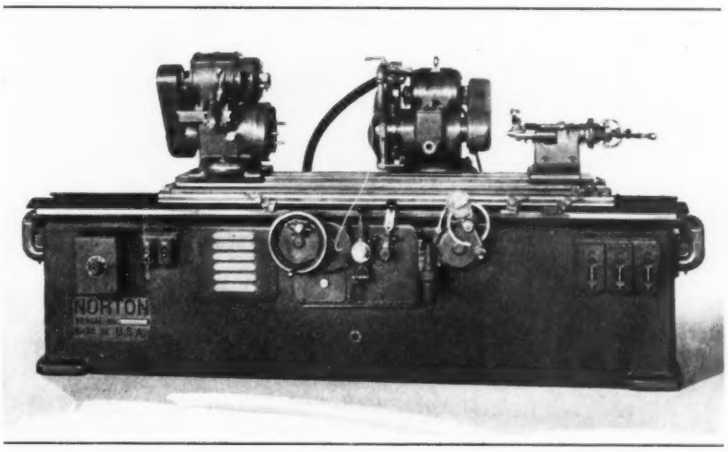


Fig. 1. Norton Multipurpose Grinding Machine with Hydraulic Table Traverse

Norton Multipurpose Hydraulic Universal Grinding Machine

A completely redesigned model of the Multipurpose grinding machine built by the Norton Co., Worcester, Mass., has been announced. This machine is much heavier than previous models, and is designed to be equally efficient for miscellaneous general production and for tool-room work. It is built with a swing of 14 inches, and in three lengths of 36, 48, and 72 inches.

Among the features that add to the versatility of the machine and to the maintenance of accuracy over a long period are a hydraulic-power work-table traverse, universal wheel-head and work-head (the latter being so arranged that either a live spindle or a dead center is instantly available), force-feed lubrication of the table ways, and a wheel-spindle in which each bearing is individually and automatically lubricated.

This machine is designed for direct motor drive only, the principal mechanisms being driven by individual motors. There are five motors, the three for the hydraulic-oil, lubricating-oil, and coolant pumps being built into the machine and included in the regular equipment.

The flat-top table is provided with a swivel adjustment at the right-hand end. Graduated scales indicate the taper for which the table is set in inches per foot, millimeters per 100 millimeters, and degrees. The universal headstock is mounted on a swivel base, and can be turned through 360 degrees and clamped in any position. Stopping and starting of the headstock are controlled by a lever which operates a cone type clutch and friction brake, so that it is not necessary to stop and start the motor. A hole extending through the spindle permits the use of a rod for a draw-in collet, a knock-out bar, or a water pipe for wet internal grinding.

The work-table can be traversed by a handwheel, in addition to hydraulic power. Hydraulic traverse is accomplished by means of a cylinder attached to the under side of the table and two pistons, the rods of which are attached to opposite ends of the base. Traverse speeds up to 144 inches a minute are available.

The universal wheel-head rests on a swivel base and compound slide, so that the wheels used in either external or internal grinding can be set at any desired angle in relation to the work. The external and internal grinding wheel-spindles are mounted on opposite sides of the wheel-head and are driven independently by a motor mounted on the wheel-head, which has a double shaft extension.

The hand-operated wheel-feed indexes to 0.0001 inch and also provides for rapid movement in locating the wheel with respect to the work. The feed may be in the normal direction, perpendicular to the table ways, or in any angular direction to which the wheel-head is set.

The 48-inch machine illustrated weighs about 8000 pounds. Wheels up to 14 by 1 1/2 inches can be mounted for cylindrical grinding or cup type wheels 12 by 3 inches for face grinding. Work 14 15/16 inches in diameter can be swung over the top of the table. A motor of five horsepower rating is required for driving the grinding wheel, and a motor of 1/2 horsepower for driving the work. 64

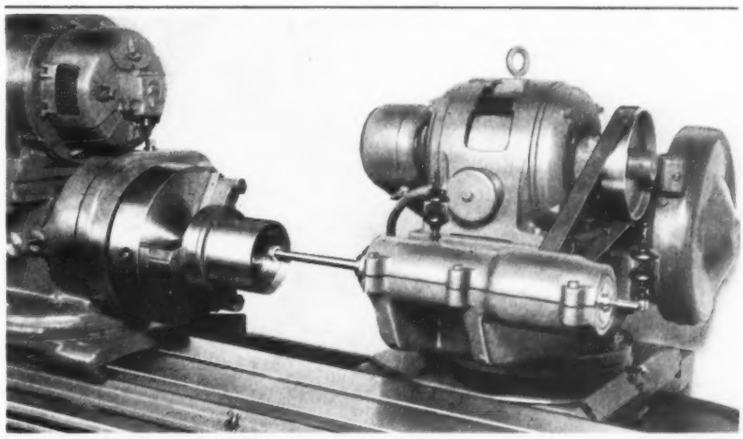
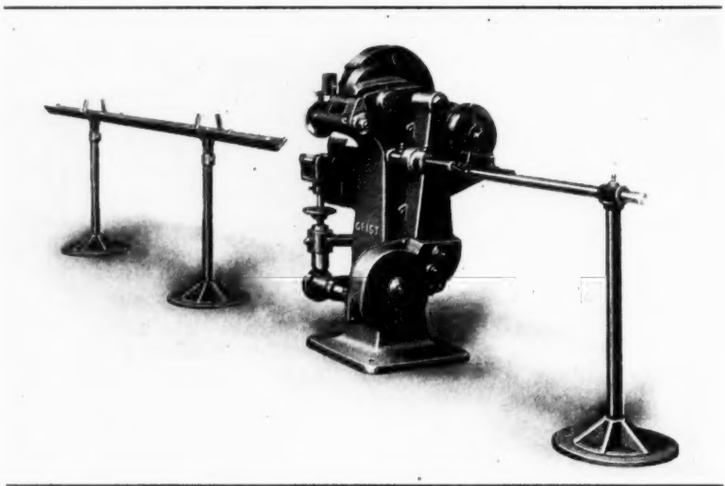


Fig. 2. Internal Grinding Operation on the Norton Multipurpose Grinder

To obtain additional information on equipment described on this page, see lower part of page 40



Geist Semi-automatic Roller Pipe-cutter with New Construction Features

Geist Semi-Automatic Roller Pipe-Cutter

The semi-automatic roller pipe-cutter recently developed by the Geist Mfg. Co., Waynesboro, Pa., is so designed that the operator is relieved of all work except feeding the pipe into the machine. This roller cutter is sold by the Landis Machine Co. of the same city.

New design features incorporated in this machine include the operation of the rollers by means of a cam action, both the hand-lever and foot-lever of the previous model having been eliminated. Movement of the rollers in a vertical plane is effected by a gear-driven disk cam, different cams being necessary for standard-wall and extra heavy pipe.

The operating cycle of the machine is controlled through pick-off gears, the gear train being so arranged that four different speeds can be obtained by either reversing one pair of gears or employing an extra pair. From ten to thirty-five nipples can be cut off per minute, depending upon the diameter of the pipe.

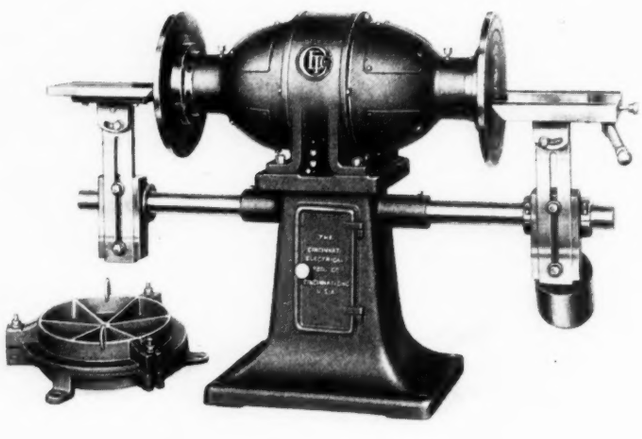
Anti-friction bearings are provided, there being a heavy-duty roller bearing for the cutter-disk spindle. A high-pressure grease system provides positive lubrication. Another feature is a lubricator, which is built into the machine for lubricating and cleaning the cutter disk. This device consists of a reservoir that holds about one pint of oil. A needle valve permits just enough lubricant to flow into two felt pads, which are held under spring tension in contact with the cutter disk. This insures continuous lubrication of the disk.

The new type of pipe support supplied is built in the form of a trough which eliminates gripping of the pipe under a cut. The trough is 10 feet long and is lined with a series of metal strips that minimize friction between the pipe and the trough. The strips also permit rapid advancement of the pipe after each cutting-off operation has been completed. The support can be conveniently raised or lowered to any desired height. 65

Cincinnati Disk Grinders

Several sizes of grinders that can be equipped with grinding disks on both sides or with a disk on one side and a conventional grinding wheel and wheel guard on the other, have been added to the line of the Cincinnati Electrical Tool Co., Division of the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio. On double-disk grinders, a table with a hand-lever feed is regularly supplied on the right-hand side of the machine and a plain table on the opposite side, but this equipment may be varied to suit individual requirements. On combination type machines, a table with a hand-lever feed is also regularly furnished on the right-hand side.

The steel disks supplied as standard equipment are accurately machined and balanced to insure true running. They can be furnished for either gluing on abrasive disks or drilled to suit the mounting of steel-back abrasive disks. A press can be



Grinder Supplied with Disks on Both Ends or with a Disk and Conventional Grinding Wheel on Opposed Ends

To obtain additional information on equipment described on this page, see lower part of page 40

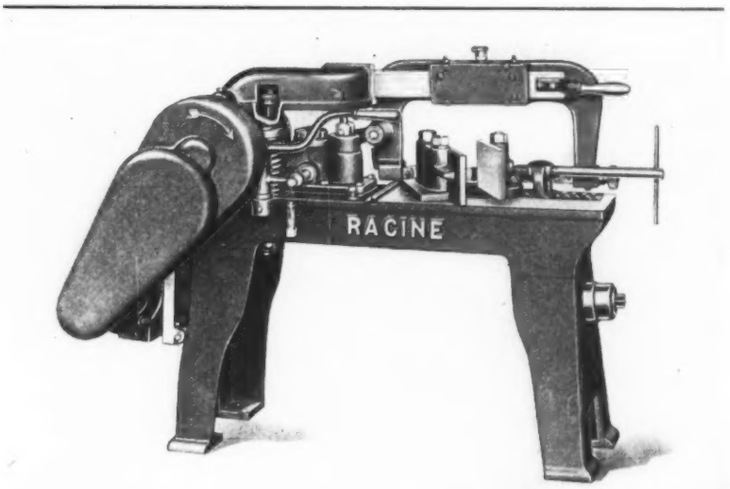
supplied for gluing the abrasive disks to the steel disks.

The spindle of these machines is made of nickel steel, is dynamically balanced, and is mounted in ball bearings designed to take both radial and thrust loads. The motor is of the fully enclosed type. The magnetic starter is provided with both overload and no-voltage protection and with a push-button control. 66

"Dual Control" Alternating-Current Welder

Separate voltage and amperage controls that enable the operator to select the most desirable voltage for the amperage used on any job is the principal feature of an alternating-current welder being placed on the market by the Miller Electric Mfg. Co., Appleton, Wis.

This "Dual Control" welder enables practically unlimited current settings. It is built in three sizes with a current range of from 10 amperes upward to permit the welding of steel sheets and plates. All three sizes have the same cabinet dimensions and vary in weight from 235 to 350 pounds. They are equipped with wheels and a handle for portability. 67



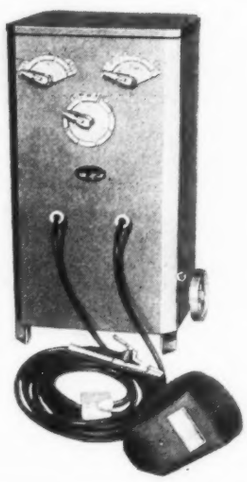
Racine Hydraulic-feed Power Hacksaw of Simplified Design

Racine Hydraulic-Feed Utility Saw

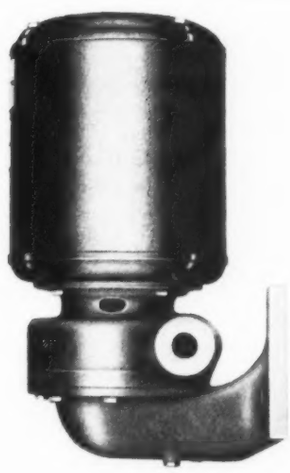
Mild or cold-rolled steel can be cut at rates of from 2 to 3 square inches a minute by a simplified power hacksaw built by the Racine Tool & Machine Co., 1752 State St., Racine, Wis., to meet the requirements of the smaller shops or for use as an auxiliary machine in the larger shops. This power hacksaw has a capacity of 6 by 6 inches. Round bars of 4 inches diameter can be cut in eight minutes and bars of 3 inches diameter in five minutes.

Two speeds of operation are available. There is a V-belt drive from the motor to the drive gears. The feed dial gives an infinite range of pressures for cutting all classes of materials, including mild, cold-rolled, tool, high-speed, and stainless steels.

The hydraulic system consists of a simple plunger pump, which is cam-operated. Hydraulic pressure is applied to the top of a feed cylinder through a valve equipped with a numbered dial to facilitate changing the pressure. The entire hydraulic system, including valves, cylinder, and controls, is self-contained. Three quarts of automotive crankcase oil suffice to operate the machine for months. 68



Alternating-current Welder with Convenient Current Adjustment



Pioneer Coolant Pump for Vertical Installation

Pioneer Vertical-Bracket Coolant Pump

A pump of vertical design, intended to be bolted directly to the side of a machine base or coolant reservoir, has been placed on the market by the Pioneer Engineering & Mfg. Co., 31 Melbourne Ave., Detroit, Mich. This Model VB pump is suitable for handling either coolants or lubricants. The pump itself is mounted directly on the end of the motor, so that a close-coupled unit is obtained.

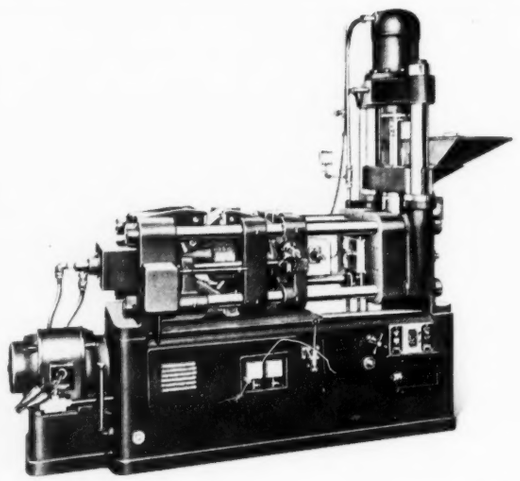
To obtain additional information on equipment described on this page, see lower part of page 40.

The intake is direct through the base bracket, the general construction of the pump being such that the entire unit is readily accessible after installation. The unit can be dismounted by simply removing the flange bolts. Relief or by-pass valves are not required in the delivery line, and any degree of throttling can be accomplished without increasing the load on the motor.

Any type of liquid can be handled with this pump that is not too highly corrosive or viscous. 69

I.M.C. Injection Molding Machine

The Index Machinery Corporation, 49 Central Ave., Cincinnati, Ohio, is the sole distributor in the United States and Canada for the Lester LPM-2 injection molding machine, intended for the production of thermo-plastic products. This machine is fully automatic and has a capacity for producing plastic castings weighing as much as 6 ounces.



I.M.C. Injection Molding Machine for Thermo-plastic Materials

In full-automatic operation, the machine cycles are controlled by two electric clocks. However, the machine can also be operated semi-automatically by a single lever. The molds are closed by hydraulic power through toggle joints which are securely locked for the injection of the plastic material in such a manner as to remove all strains from the toggle pins.

Another feature of this machine is the method of adjusting the mold on the tie-bars. This is accomplished through the use of worm-gearing which advances the die-plates uniformly so that they are parallel at all times. The entire heating cylinder is chromium-plated, and as the heating cylinder assembly swings away from the machine, easy accessibility is afforded for adjustments. The 8 1/2-inch injection stroke takes three seconds. 70

Reeves Improved Vari-Speed Countershaft Type Motor Pulley

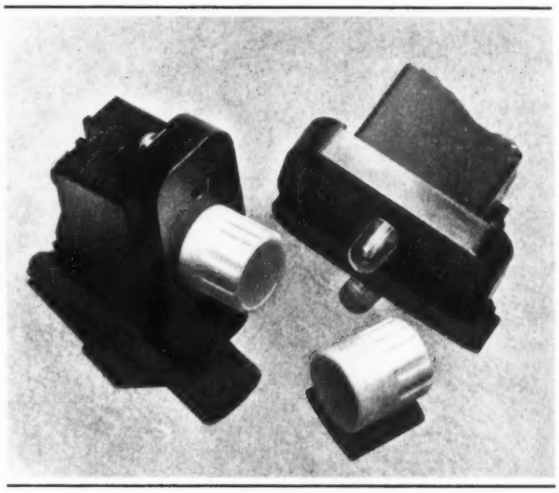
An improved design of the Vari-speed countershaft type motor pulley made by the Reeves Pulley Co., Columbus, Ind., has been brought out. This motor pulley is a compact variable-speed unit which can be mounted on the standard shaft extension of any constant-speed motor. It provides a direct drive from the motor to the driven machine. Through a handwheel control, a sliding base on which the motor and variable-speed unit are mounted can be moved forward or backward to vary the diameters of a set of adjustable disks from which a V-belt is connected to the driven machine. In this way, desired speed changes can be obtained.

For unusual speed reduction or increase, a countershaft is mounted on a common base with the remainder of the unit. In the former design of the unit, the pulley on this countershaft, from which power was delivered to the driven machine, was mounted on the end of the shaft. In the new design, this pulley may be mounted in the center of the countershaft between two bearing housings, thus providing a more compact unit suited to installations in which limited space is an important factor.

Vari-speed Motor Pulley with Pulley Mounted in Center of Countershaft

While a straight-face pulley is illustrated, a sprocket, pinion, multiple V-belt, sheave, or other type of drive can be furnished. This variable-speed unit is built in seven sizes for transmitting from fractional horsepower to 7 1/2 horsepower at speed ratios up to 3 to 1. 71

To obtain additional information on equipment described on this page, see lower part of page 40



Push-button Station with Lamp in Center of Button

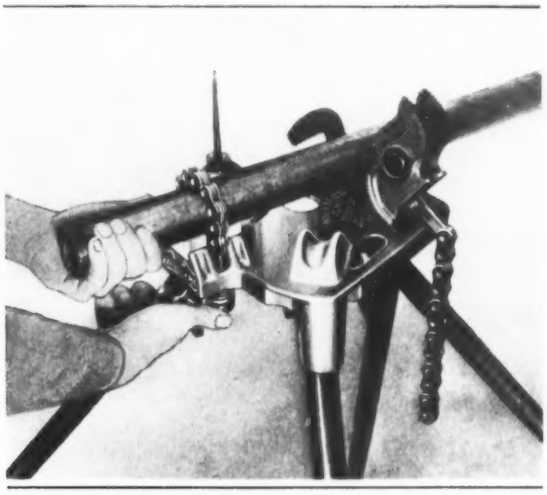


Fig. 1. Williams Combined Vise Stand, Pipe Vise, and Pipe Bender

General Electric Illuminated Push-Button Station

A small standard-duty push-button station with an indicating lamp in the center of a translucent button has been placed on the market by the General Electric Co., Schenectady, N. Y., for application to machinery. By combining the push-button and indicating lamp in a single compact unit, this station requires only about one-half the space necessary when these two devices are mounted separately. The new station is available with white, green, blue, red, clear, and amber buttons.

The indicating lamp is operated through a small control transformer which, because of its diminutive size, can be mounted readily in or on a machine. The push-button station is only 2 5/8 inches high, 1 1/4 inches wide, and 2 5/8 inches thick. 72

Recent Products of J. H. Williams & Co.

A vise stand, chain pipe vise, and pipe bender are all combined in the portable Vulcan vise stand V-1, illustrated in Fig. 1, which was recently placed on the market by J. H. Williams & Co., 75 Spring St., New York City. The base of this unit is a malleable-iron casting that is supported on legs of 1-inch pipe. These legs are provided with upset feet punched for fastening to the floor if desired. They can be folded together for convenience in carrying the stand from place to place.

The vise jaw is made of tool steel and is hardened and tempered. The vise stand weighs 35 pounds and accommodates pipe from 1/8 inch to 2 inches, while the pipe bender handles pipe up to 3/4 inch.

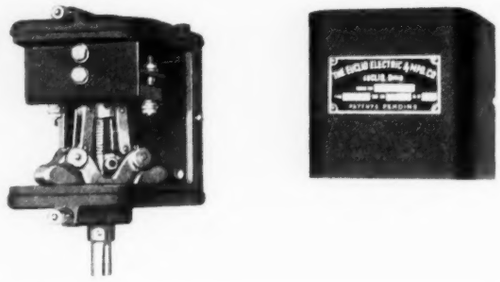
The same concern has also brought out a Vulcan "Supertong" chain pipe tong, as shown in Fig. 2, which is drop-forged from alloy steel of high tensile strength. This tong is claimed to be at least 50 per cent stronger than the regular Vulcan tongs of corresponding size, although there has been no increase in weight or dimensions. It is equipped with "Superchain," which is made from alloy steel, heat-treated and cadmium-plated. There are eight sizes of this tong for pipe from 1/8 inch to 18 inches.

J. H. Williams & Co. are also announcing a new line of heavy-pattern "hex-box" wrenches designed for severe service. The heads of these wrenches are of approximately the same thickness as the nuts for which they are intended. Their comparatively thin head walls are especially useful in close quarters. The openings range from 1 1/4 to 3 1/8 inches. These wrenches are manufactured in two lines, drop-forged from carbon steel and chromium - molybdenum steel. 73

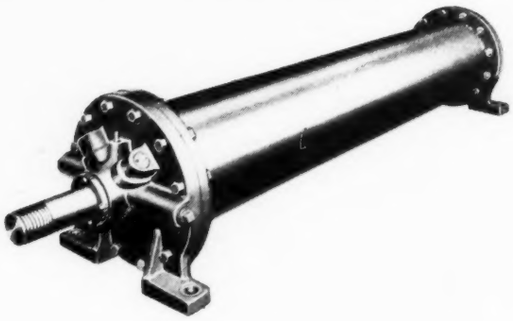
Fig. 2. Vulcan Supertong Made for Pipe from 1/8 Inch to 18 Inches

Fig. 3. Hex-box Wrench Made from Carbon and Chromium-molybdenum Steels

To obtain additional information on equipment described on this page, see lower part of page 40.



Switch for Quickly Stopping Alternating-current Motors by Plugging, and Other Applications



Hannifin Extra Heavy Air Cylinder with Mirror-like Honed Bore

Euclid Centrifugal Switch

A centrifugal switch intended for such applications as the quick stopping of alternating-current motors by plugging, the prevention of plugging, and the positive interlocking of several motions, as well as for use as an over-speed or under-speed switch, has been added to the line of the Euclid Electric & Mfg. Co., Euclid, Ohio.

This switch has silver-to-silver contacts of 10 amperes maximum capacity, which are replaceable when necessary. It can be provided with the contacts normally open when the switch is at rest, which is the arrangement required for use as a plugging switch, for most interlocking applications, and for under-speed service. This normally open type can be furnished in a single-circuit form, as required for plugging applications in which the motor runs in one direction only, and also in a two-circuit form, as required for plugging in either direction with a motor that can run in both directions.

The switch can also be supplied with contacts normally closed when the switch is at rest, which is the arrangement required for use as an anti-plugging device or for over-speed service.

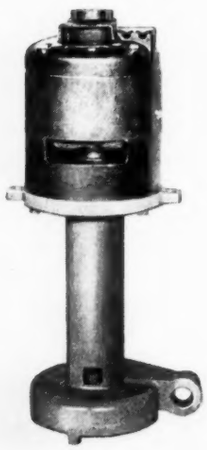
The switch is built to withstand a speed of 1800 revolutions per minute, but it can also be furnished for higher speeds.—74

Hannifin Heavy-Duty Air Cylinders

Extra heavy air cylinders with a honed mirror-finished bore especially adapted for steel mill and other heavy-duty applications, have been brought out by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. The bore of these air cylinders is straight, round, and concentric within 0.001 inch. The honing operation is performed on a special long-stroke machine built in the Hannifin shops for this purpose. The honing head operates at a uniform pressure, which can be adjusted to suit different sizes of cylinders.

The flanges of these air cylinders are screwed on and then welded to the cylinder body. The heads are of cast steel, and are available with or without an air cushion at either or both ends.

These LO series heavy-duty air cylinders are being made in a full range of standard sizes up to 16 inches bore, for any length of stroke and for air pressures up to 250 pounds per square inch. The cylinder illustrated has a bore of 16 inches diameter and is intended for a piston stroke of 7 feet. The advantages claimed for honed air cylinders are sustained high efficiency and economical use of air power.—75



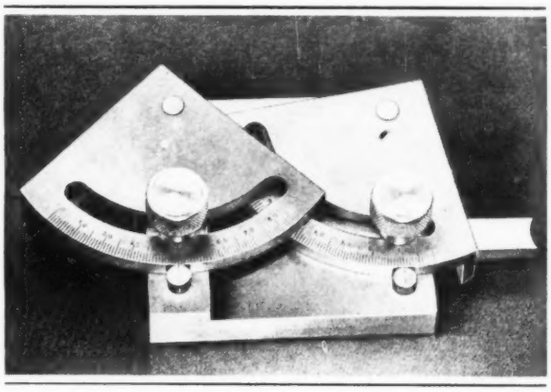
Goulds Vertical Centrifugal Pump for Coolants

Goulds Vertical Centrifugal Coolant Pump

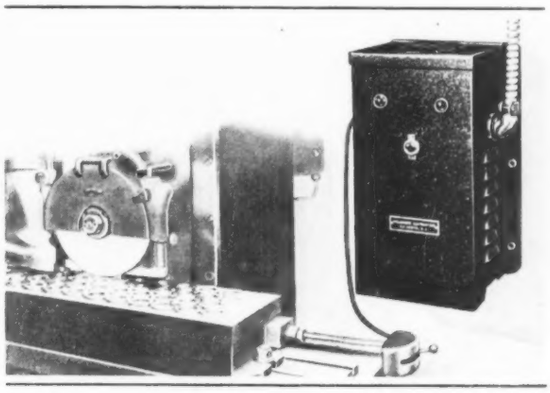
A vertical submerged type of centrifugal pump designed to occupy little space in an installation is being manufactured in a 3/4-inch size by Goulds Pumps, Inc., Seneca Falls, N. Y. This pump is intended especially for the circulation of coolants and cutting compounds that may or may not contain abrasives in suspension.

The impeller is mounted directly on a large-diameter extended motor shaft, thus eliminating the necessity of a lower pump bearing. The pump casing is cast integral with the motor support, at the top of which the motor is held by a locking arrangement that insures permanent alignment.

To obtain additional information on equipment described on this page, see lower part of page 40.



Universal Adapter for Grinding Tools to Similar or Different Angles at One Setting



Mellaphone Rectifier which Produces Direct Current for Magnetic Chucks

The motor is of 1/4 horsepower rating and runs at 1750 revolutions per minute. Up to 30 gallons of oil can be pumped per minute and heads may vary up to 19 feet. The pump is about 20 inches high. 76

Universal Adapter for Use in Tool Grinding

Tools of tungsten carbide and other alloys can be conveniently ground to two similar or different angles at one setting of a universal adapter or fixture, placed on the market by the American Tool & Die Co., 439 E. Fort St., Detroit, Mich. This device is made with two plates that can be pivoted to the angles to which tools are to be ground and securely clamped. The tools that are to be ground are held along the edges of these pivot plates. Graduations facilitate setting the plates to the required angles.

In grinding tools with this adapter, the thrust is always against a solid stud. The body of the adapter is made of tool steel and hardened, so as to minimize wear due to sliding across the table of the grinding machine. A key bolted to the under side of the adapter body for engaging a guide-way in the grinding machine table is also hardened and ground. Sharp corners at both ends of the key sweep the guide-way clean of abrasive. 77

Current Rectifier for Magnetic Chucks

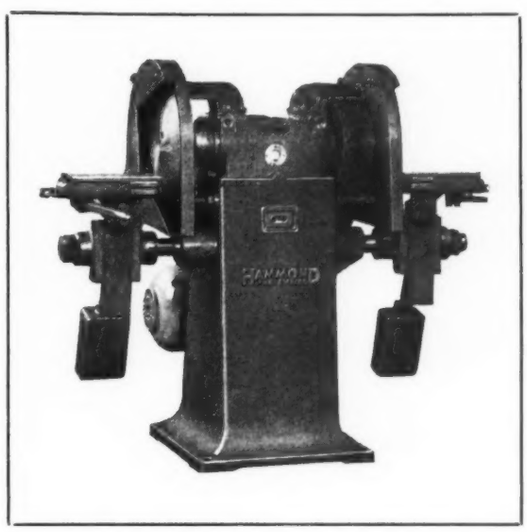
An electronic rectifier intended for use instead of a generator in operating magnetic chucks has been placed on the market by the Mellaphone Corporation, Rochester, N. Y. This rectifier uses a mercury vapor tube, and it is easily installed, as it requires only to be connected to an alternating-current line and to the switch of the magnetic chuck. Other advantages are that there are no moving parts to wear out and that dust, grit, or moisture cannot affect the mercury vapor tube.

This rectifier can be supplied for either 110- or 220-volt alternating current, delivering direct current of the same voltage to the magnetic chuck. The model illustrated operates on 110-volt alternating current and has an output capacity of 220 watts. 78

Hammond V-Belt Disk Grinders

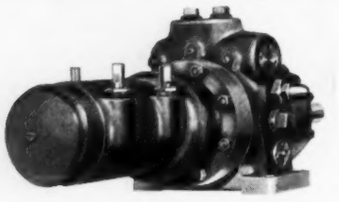
Hammond Machinery Builders, Inc., Kalamazoo, Mich., have added two disk grinders of the construction illustrated to their line of grinding equipment. These new models are equipped with 18- or 20-inch disks. The spindle is 29 inches long over all and is mounted in four Timken tapered roller bearings. It is driven by either a 5- or a 7 1/2-horsepower motor through multiple V-belts.

The universal lever-feed tables of these machines measure 6 by 11 inches. However, plain tables, 7 1/2 by 18 inches, may be supplied. The rocker shaft is 2 1/2 inches in diameter by 58 inches long. The base is 24 inches square. 79



Hammond Disk Grinder, Built in Two Models with Multiple V-belt Drives

To obtain additional information on equipment described on this page, see lower part of page 40.



Hydraulic Pump with Control Valves in Pump Housing

Sundstrand Hydraulic Pump Units

Hydraulic pump units in which the control valves are built into the pump housing have been brought out in two sizes by the Sundstrand Machine Tool Co., 2530 Eleventh St., Rockford, Ill. A new feature of the larger model 10PWX unit is a variable-displacement piston pump which can be furnished with fast, medium, and slow feed rates. Each rate is independently adjustable.

The three feed rates are especially advantageous in wide-facing operations, as well as in boring, reaming, and counterboring holes of multiple diameter. There is also a constant-volume pump in this unit to provide rapid traverse, in addition to the variable-displacement piston pump. Both pumps are driven from one shaft.

The main control mechanism is in the pump housing, and can be actuated by a simple hydraulic remote-control valve which is tripped by dogs on the moving member. An alternative control is by means of electrical switches and trip-dogs which operate in conjunction with solenoid valves. The same control arrangement is used for the smaller model 5PWX unit, which, like the standard model 10PWX, has two independently adjustable feed rates, in addition to the rapid traverse.

The small size of these pump units, together with their simple and flexible control, makes them especially suitable for machine tool feeds and similar applications. They are driven at a motor speed of 1200 revolutions per minute. 80

Gair-Lock Inserted-Blade Cutters

Adjustable inserted cutter blades for application to various types of single- and multiple-blade tools, including boring-bars, boring heads, milling cutters, and reamers, are being placed on the market by the Gairing Tool Co., 1629 W. Lafayette Blvd., Detroit, Mich., under the trade name of "Gair-Lock." The locking member of these blades is positioned in a shouldered recess adjacent to the blade slot, as seen in Fig. 2. It fits the serrated blade and locks it securely to the body. Both the blade and the locking member are inserted lengthwise in the cutter body.

One of the chief advantages claimed for this blade design is the facility of adjustment. By tapping the rear of the blade, it is instantly released and can then be set outward the required distance. A single blade can be removed and replaced without loosening any other blades in the cutter-head. Blades can be set at desired angles to give a solid cutting action.

The Gair-Lock unit is said to prevent blade shifting or tilting to permit the use of more blades for a given cutter diameter, afford a large amount of chip clearance, and eliminate the necessity of serrating the cutter body. Special bodies are not required for tungsten-carbide tipped blades. 81

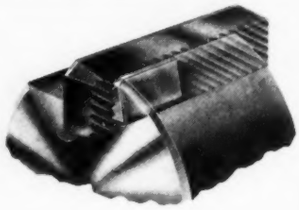


Fig. 2. Phantom View of Gair-Lock Inserted Cutter Blade

Gray Turret-Head Metal-Cutter

A No. 4-A turret-head metal-cutter or nibbling machine has recently been added to the line of equipment built by the Gray Machine Co., Box 596, Philadelphia, Pa. This machine has a capacity for nibbling material up to 3/8 inch in thickness. The throat is 24 inches deep.

Except for the throat depth and the location of the drive-shaft above the frame instead of extending through it, the machine follows the same general design as the metal-cutter described in February MACHINERY, page 421. 82

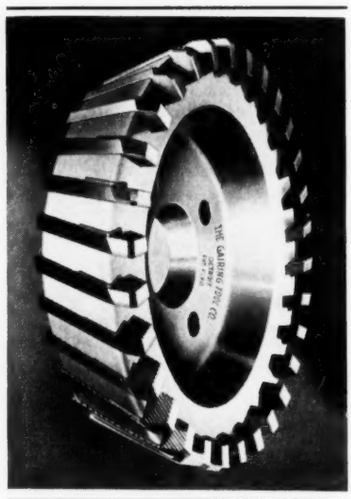
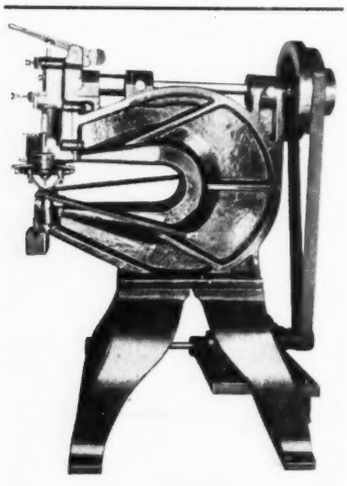
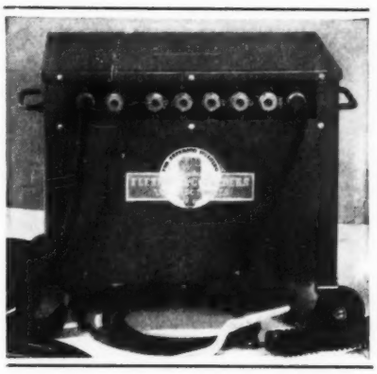


Fig. 1. Milling Cutter Equipped with Gair-Lock Inserted Blades



Gray Turret-head Metal-cutter for 3/8-inch Material

To obtain additional information on equipment described on this page, see lower part of page 40.



Westinghouse Small Alternating-current Arc Welder

Westinghouse Alternating-Current Welder and Electrodes

An alternating-current arc welder designed to provide low-cost equipment for use in maintenance and light construction work has been placed on the market by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., under the trade name of "Midget Marvel." These welders are made in 50- and 60-cycle models.

The new welders are particularly adapted for use in automobile-service, blacksmith, general-repair, farm, sheet-metal, and other shops requiring light-duty equipment. The current range is from 30 to 140 amperes, there being twelve steps of current adjustment. Coated electrodes from 1/16 to 5/32 inch diameter can be used. Each welder is approximately 14 inches high, 11 inches wide, and 18 inches long.

The same concern has also developed recently a line of "Crucible-Weld" coated electrodes for alternating-current service which includes diameters from 3/32 to 5/16 inch. In addition, there is a special 1/16-inch diameter electrode for use with very low current values.

These electrodes are made in two grades of black and brown. The black electrodes are especially suitable for down hand butt-welding because of their high melting rate and ability to operate on high current values with low spatter loss. Good slagging characteristics permit their use on surfaces having a slope as large as 30 degrees. These electrodes are also satisfactory for welding horizontal fillets.

The brown electrodes are intended for all general-purpose work, including horizontal, vertical, and overhead welding. These electrodes are also suitable for welding fillets either in a single or multiple pass. The 1/16-inch electrode is useful in all-around work, including repairing of automobile fenders. 83

Atlas Safety Belt Guards

Lathes of the 9 or 10 series built by the Atlas Press Co., Kalamazoo, Mich., which are equipped with a self-contained countershaft, may now be provided with safety belt guards of the designs here illustrated. The guard at the left covers the motor-to-countershaft belt, and is also made with a special inner guard for the pulley on the countershaft. The guard at the right covers the belt that runs from the countershaft to the lathe spindle.

Both guards are aluminum castings. They are provided with pin hinges, which enables them to be raised quickly in making speed changes. It is not necessary to remove the guards in order to change belts. 84

Aluminum Belt Guards for Atlas Lathes

Dumore Lathe Grinder for Use on Machine Tools

Dumore Grinder for Application to Machine Tools

A No. 12 grinder which is applicable to lathes, planers, shapers, milling machines, etc., has been added to the line of the Dumore Co., Racine, Wis., under the trade name of "Chief." This grinder can be employed for both external and internal grinding on a lathe for work that must be accurate to 0.0001 inch. Surface grinding operations can be performed on planers and other machines. The grinder is driven by a 1-horsepower motor and is designed for larger and heavier work than previous lathe grinders manufactured by this concern.

Power is transmitted from the capacitor motor through two V-belts, provision being made for adjusting the tension in the belts. Six sheaves are furnished to provide spindle speeds from 2800 to 8200 revolutions per minute, suitable for wheels from 8 to 3 inches in diameter. Six spindle quills, one external and five internal, are available, the external quill taking the entire range of wheel diameters.

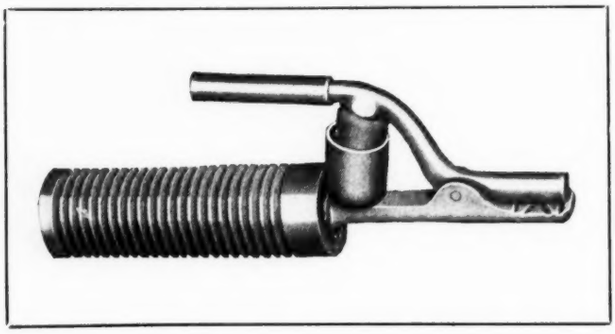
All of the internal quills are suitable for grinding holes up to 2 3/8 inches in diameter, but they vary as to the depth of hole that can be ground. Holes up to 24 inches deep are covered by the five quills. The centering of a quill with the work is facilitated by a vertical feed-screw. 85

To obtain additional information on equipment described on this page, see lower part of page 40.

Jackson Electrode-Holder

A welding electrode-holder in which light weight is combined with maximum electrical conductivity has been introduced on the market by the Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. The Model B-4, here shown, weighs only 15 ounces. It has a current capacity of 200 amperes, is made entirely of Mallory 3 metal and handles electrodes from 1/16 to 3/16 inch. The alloy from which the holder is made provides sufficient strength, and at the same time, possesses 85 per cent of the conductivity of pure copper.

This holder is easy to handle and is small enough to be successfully manipulated in tight places. The handle insulation is ventilated, and both the upper tong and compression spring are fiber-insulated. 86



Jackson Electrode-holder for Light Welding

Jarvis "Vario-Flex" Flexible-Shaft Machine

From twelve to fourteen speed changes can be made instantly on the Vario-Flex flexible-shaft machine here illustrated, which is a recent development of the Charles L. Jarvis Co., Middletown, Conn. Speeds are changed without shifting the belt or stopping the machine. The range of speeds enables grinding wheels to be operated continuously at the same surface speed, regardless of the diameter to which they may be worn.

This machine is manufactured in three sizes of 1, 1 1/2, and 2 horsepower. The smallest size can be run at speeds of 2200 to 4700 revolutions per minute, and the two larger sizes at speeds of from 2000 to 4500 revolutions per minute. The hand-piece is of a heavy-duty construction with two double-row ball bearings. It is provided with a 3/4-inch diameter spindle on the two small models and with a 1-inch spindle on the two-horsepower machine.

The motor unit can be swiveled through a full 360 degrees. Rubber-tired ball-bearing wheels are provided. 87

Jarvis Flexible-shaft Machine with Fourteen Speeds

Complete Range of Fafnir Self-Aligning Ball Bearings

Three distinct types of self-aligning ball bearings are now manufactured by the Fafnir Bearing Co., New Britain, Conn., in a full range of sizes. In the B type bearing, the outer ring is made with its outside surface spherical instead of cylindrical. A concave inner surface in the housing, which corresponds to the convex outer surface of the ring, permits the bearing to swivel into true alignment with the shaft.

In the S type bearing, the conventional cylindrical inner surface of the housing is retained and an extra self-aligning ring with a concave inner surface is provided. This extra ring surrounds the spherically ground outer ring to form the alignment socket. An advantage of this bearing is that it requires only a simple straight-bore housing. Another feature is a ring-to-ring contact without any movement against the housing.

The L type bearing provides self-alignment entirely from within the outer bearing ring, so that the housing can be straight-bored and of minimum diameter. A double row of balls is used in all L type bearings, including the single-row widths. The two rows of balls, which run in two races on the inner ring, are left free to locate themselves in one spherical race on the outer ring. Here the balls themselves roll the inner ring and shaft into alignment.

All of these self-aligning bearings are available in single- and double-row types, and also in the wide inner-ring type. 88

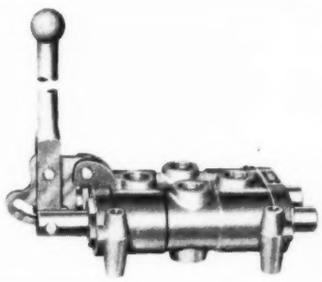
Metzgar End-Wood Sheaves

Sheaves made of selected hard maple and chemically treated are being made to specifications in

End-wood Sheave Made to Any Size by the Metzgar Co.

To obtain additional information on equipment described on this page, see lower part of page 40.

all sizes by the Metzgar Co., Grand Rapids, Mich. They can be supplied either for fastening to a shaft or fitted with oilless end-wood, ball, or roller bearings. These sheaves are of the same construction as the patented end-wood truck wheels manufactured for years by the company. 89



Hunt Hydraulic Valve for Four-way Operation

Hunt Hydraulic Valve

A hydraulic valve is now being manufactured by C. B. Hunt & Son's Co., Salem, Ohio, which is designed on the same no metal-to-metal wear principle that characterizes the Quick-As-Wink air control valves made by the concern. The hydraulic valve is also made with a minimum number of moving parts. The use of a forged bronze housing provides high physical strength, and in addition, insures long life when the valve is used with water or corrosive fluids.

The illustration shows a valve designed for four-way operation, but two-way and three-way models are also made. There are 1/2, 3/4, and 1 inch sizes of this valve and two styles for working pressures of 1000 and 2000 pounds per square inch.

With the Quick-As-Wink principle, the valve operation is accomplished in two-way valves by only one moving part, and in three-way and four-way valves by the coincident motion of two valve bodies or plungers. The valve bodies or plungers are made of stainless steel, and are free-floating in special packings, thus avoiding a metal-to-metal contact. A balanced port action in conjunction with the valving ring and the no metal-to-metal contact is claimed to provide long life and satisfactory action under hard service. 90

* * *

The Lincoln Arc-Welding Competition

According to information just received from the Lincoln Arc Welding Foundation, requests for the book of rules and conditions covering the arc-welding competition sponsored by the James F. Lincoln Arc Welding Foundation, P. O. Box 5728, Cleveland, Ohio, have come from about one thousand cities and towns representing every state in the Union. By far, the larger number of inquiries have been from engineers, designers, and architects.

The widespread interest evidenced is obviously due primarily to the number and size of the awards. There are 446 separate awards ranging from $100 to $10,000, with a grand award of $13,700. Anyone engaged in the design, engineering, manufacture, fabrication, or construction of metal products or structures may participate.

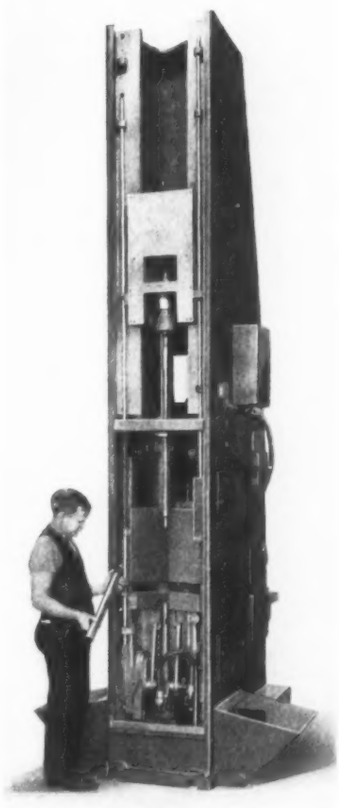
* * *

High-Speed Broaching of Splines in Propeller-Shaft Tubes

Involute splines are being broached on the inside of propeller-shaft tubes by the machine here illustrated at a speed of 139 tubes an hour. The machine is of the standard heavy-duty vertical "Pullup" type built by the Colonial Broach Co., Detroit, Mich. It is of 15 tons capacity and has a stroke of 60 inches. When in the loading position, the broach is in the base, so that the tube to be broached can be placed over the upper end of the broach. When the machine is started, the broach is raised by a cylinder in the base until it engages with an automatic puller in the ram.

The ram then feeds up, pulling the broach through the tube, thus roughing and finishing the splines at one stroke. When the ram reaches the top of its stroke, the tube is released and removed from the machine, after which the ram returns the broach to the base and releases it to permit another tube to be loaded. The operation of this machine is automatic throughout, no handling of the broach being required.

The illustration shows the broach in the raised position just after removing a propeller-shaft tube. A cover plate which normally closes the lower front side of the machine was removed at the time that the photograph was taken so as to show the mechanism that raises the broach to the ram pull-head.



Rough- and Finish-broaching Splines in Automobile Propeller-shaft Tubes

To obtain additional information on equipment described on this page, see lower part of page 40

Selling Alloy Steel with Certified Analyses and Heat-Treatment Characteristics

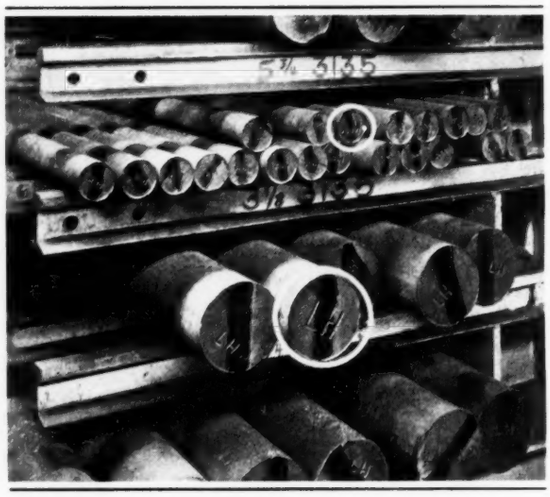
MOST of the alloy steel used today is subjected to heat-treatment before use for the purpose of developing strength, hardness, resistance to shock, and other desired physical characteristics. The response of alloy steel to heat-treatment depends partly upon its analysis and partly upon the general hardening characteristics of the particular heat from which the steel was produced, because the physical characteristics are governed, not only by the analysis, but also by the structure of the material, the inherent grain size, etc.

The accuracy to which a melter can work is limited, and for this reason, the S A E specifications, which cover the great majority of alloy steels used today, have relatively wide limits. Because of the wide limits, steel made to S A E specifications may vary greatly in heat-treatment response from one heat to another. This variation frequently results in non-uniformity and extra expense for re-heat-treatment.

When large tonnages are involved, the user can purchase whole heats, and then it is practical for him to analyze each heat and to test it for heat-treatment response. In this way, he is able to control heat-treatment processes, so as to offset any differences between heats. However, when average lots of alloy steel are purchased from stock, a customer can hardly afford to perform expensive analysis and heat-treatment tests on the different bars as they are received.

This condition led Joseph T. Ryerson & Son, Inc., to develop a Certified Steel Plan, under which each customer of alloy steel receives complete data relative to his purchase, which has been obtained through analyses and tests made before the steel is delivered. In evolving this plan, the Ryerson organization encountered two principal problems: The first was to obtain standard alloy steels for stock that would conform to an analysis range closer than specified in the S A E ranges and that would be closely controlled with respect to the general hardening characteristics, such as inherent grain size. The second problem, after having secured such steels, was to develop a method of informing each customer as to the complete analysis and heat-treatment characteristics of each bar shipped to him.

The first problem was solved by writing specifications for all alloy steels on a much closer chemical analysis basis than the standard S A E specifications and including in these specifications other factors that govern the heat-treatment responsiveness of each type of steel. Each selected heat that comes within these closer specifications is identified by letter symbols before it is rolled into bars. Identification letters are also stamped on the ends of each bar of a given heat, as shown in the illustration, or in the case of small bars, the bundles are tagged. Heat-treating tests are made on standard specimens from each heat.



Letter Symbols are Stamped on the End of Each Bar Sold under the Ryerson Certified Steel Plan

In order to convey complete information regarding these special heats to the customer before he uses the steel, two types of charts were devised, one for carburizing steels (casehardening) and the other for steels that are heat-treated by quenching. In the case of carburizing steels, the chart gives the heat analysis, identifying letters, McQuaid Ehn grain size, cleanliness rating, and also the results of a carburizing test on a standard sample, such as the hardness of the case, the effective depth of the case and the physical characteristics of the core. Such information as the tensile strength, yield point, elongation, reduction of area and Brinell hardness are given.

In the case of a quenching steel, the analysis, identifying letters, McQuaid Ehn grain size, and cleanliness rating are also shown, together with a chart in which curves indicate the tensile strength, yield point, elongation, reduction of area, Brinell hardness, etc., as determined from test specimens hardened at a suitable temperature for the analysis and drawn at various temperatures.

Before the customer subjects the steel to heat-treatment, he has complete information concerning the particular steel with which he is dealing. By filing these charts, a record can be maintained of the composition and characteristics of the steel used in every job that goes through the shop.

Having accumulated sufficient stocks of these accurately controlled steels to be able to give prompt shipment on practically any size or analysis, the Ryerson organization is now announcing this Certified Steel Plan to industry.

* * *

A Motion Picture Film of Steel Production

The United States Steel Corporation recently started the filming of the story of steel production, from the mine to the finished product. The film will be produced by Technicolor, Inc. Twenty mines and steel plants will cooperate in its production. Since the picture will also be sound-recording, it will bring screen presentation of steel production to the highest degree of realism. The picture will start with mining operations at Hibbing, Minn., and finish with the final operations in producing rolled steel in the Pittsburgh district.

NEWS OF THE INDUSTRY

Illinois

LINK-BELT CO., Chicago, Ill., is expanding the foundry of its Pershing Road plant. The expansion and remodeling will provide 40 per cent more floor area. Various departments will be rearranged and re-equipped for maximum efficiency, increasing the capacity of the foundry to 1000 tons of castings per month. The work, which was begun March 15, has been carried on so as to permit foundry operation during the entire period. The building improvements include a new two-story section extending the full length of the foundry, and an extension at the north of the present foundry, as well as a new second floor at the north end.

R. R. WEDDELL, manager of the Small Tool Division of the Ingersoll Milling Machine Co., Rockford, Ill., recently made a short business and pleasure trip to Europe. While abroad, Mr. Weddell, formerly consulting engineer for Richard Lloyd & Co., Ltd., of Birmingham, England, visited various tool concerns in England.

R. G. DICKENS has been placed in charge of sales and service, in the Chicago district, of all types of clutches made by the Hilliard Corporation, Elmira, N. Y. His office is at 201 N. Wells St., Chicago, Ill.

Maryland

RAYMOND H. DAUTERICH, 1205 E. 25th St., Baltimore, Md., has been appointed direct factory representative of the High Speed Hammer Co., Inc., Rochester, N. Y., maker of High Speed riveting hammers, High Speed precision drills and the Bruno slotting attachment for shapers, in the states of Maryland, Delaware, Washington, D. C., and middle Pennsylvania.

MERCOID CORPORATION, 4201 Belmont Ave., Chicago, Ill., manufacturer of automatic controls, announces the opening of a new office at 1035 Cathedral St., Baltimore, Md.

Massachusetts

HEALD MACHINE CO., Worcester, Mass., held an employe's outing and picnic at Lake Pearl, Wrentham, Mass., Saturday, July 31, at which some 3000 employes and members of their families were present. The outing was pronounced a great success by the participants, many different types of entertainment being available.

W. H. SCHERER has been appointed manager of the Holyoke, Mass., plant of the Worthington Pump & Machinery Corporation, Harrison, N. J. Mr. Scherer has been connected for thirty years with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., having been general superintendent of the Westinghouse East Springfield Works for the last eighteen years.

Michigan and Wisconsin

CARBOLOY COMPANY, INC., Detroit, Mich., has bought the entire assets and interests in the cemented-carbide business of the UNION WIRE DIE CORPORATION, which has been engaged in the manufacture and sale of Widia cemented-carbide drawing and extrusion dies. Both "Unwidies" (Widia cemented-carbide dies) and Carboloy cemented-carbide dies will be continued to be supplied through the same channels of sales and service as in the past.

CHAIN BELT CO., Milwaukee, Wis., has just completed the erection of a new building at its West Milwaukee Works to house the machine shop and West Milwaukee offices. All machine operations except the assembly and manufacture of steel and malleable chains and the finishing of sprocket wheels will now be done at the West Milwaukee plant.

Missouri and Tennessee

BUNTING BRASS & BRONZE CO., Toledo, Ohio, has removed its Kansas City branch sales offices and stock-rooms to newly equipped and much larger quarters at 1922 Grand Ave.

FOOTE BROS. GEAR & MACHINE CORPORATION, 5301 S. Western Blvd., Chicago, Ill., has recently appointed EUGENE D. WILSON, 703 Columbian Mutual Tower, Memphis Tenn., district manager.

New York and New Jersey

OWEN C. JONES has been appointed assistant to the president, in charge of sales promotion, of the Laminated Shim Co., Inc., Long Island City, N. Y., manufacturer of Laminum precision adjustment shims. For the last six years, Mr. Jones has been associated with the general publicity department of The Linde Air Products Co., a unit of Union Carbide and Carbon Corporation, New York City.

GORDON SCHUTZENDORF is the newly appointed sales representative of the BUNTING BRASS & BRONZE CO., Toledo, Ohio, in the eastern territory. Mr. Schutzendorf will make his headquarters in the company's New York City branch offices.

HIGH SPEED HAMMER CO., INC., Rochester, N. Y., has appointed MAURICE MAYER 49 Pearl St., Hartford, Conn., direct factory representative for its full line of cold riveting machinery and precision drilling machines.

JOHN L. ALDEN, until recently manufacturing engineer at the Hawthorne Works of the Western Electric Co., has been made superintendent of manufacturing engineering at the Kearney, N. J., Works of the same company. Mr. Alden entered the employ of the Western Electric Co., in 1926 as contract engineer in New York City, and has since held various positions with the company. Prior to coming with the Western Electric Co., he was sales engineer for the Oneida Steel Pulley Co., Oneida, N. Y.; superintendent and assistant mill manager for the Ludlow Mfg. Associates, Ludlow, Mass.; and chief engineer of the American Insulating Machinery Co., Philadelphia, Pa.

Pennsylvania

WALTER DUGAN WOOD, JR., has been appointed to the sales staff of the Philadelphia office of the Lincoln Electric Co., Cleveland, Ohio, manufacturer of arc-welding equipment.

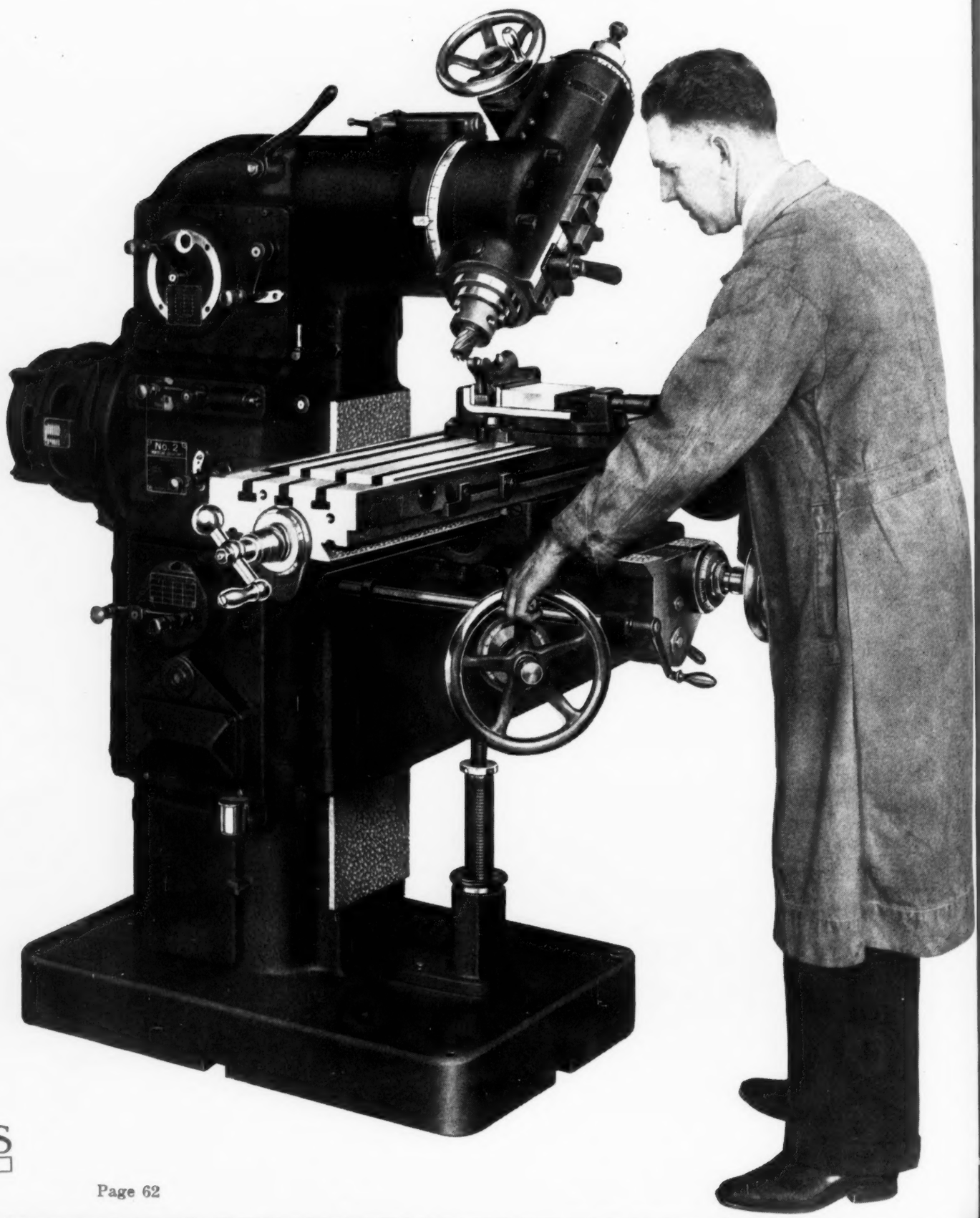
SPAULDING F. GLASS has become associated with the United Drill & Tool Corporation, 100 S. Jefferson St., Philadelphia, Pa., in the capacity of assistant treasurer.

Ohio

NATIONAL TOOL CO., 11200 Madison Ave., Cleveland, Ohio, has been reorganized and a new company by the same name incorporated under the laws of Ohio. A. J. BRANDT, an industrial engineer with international experience, is president; E. J. LEES, formerly with the Lees-Bradner Co., vice-president and chief engineer; L. M. PROSSER, formerly with the General Motors Corporation, vice-president and treasurer; S. J. KORNHAUSER, secretary and general counsel; and G. KOCHENDERFER, sales manager.

CITY ENGINEERING CO., Dayton, Ohio, has moved into a new plant at 2nd and Webb Sts. in that city. The new plant,

"LIGHT TYPES" - - -

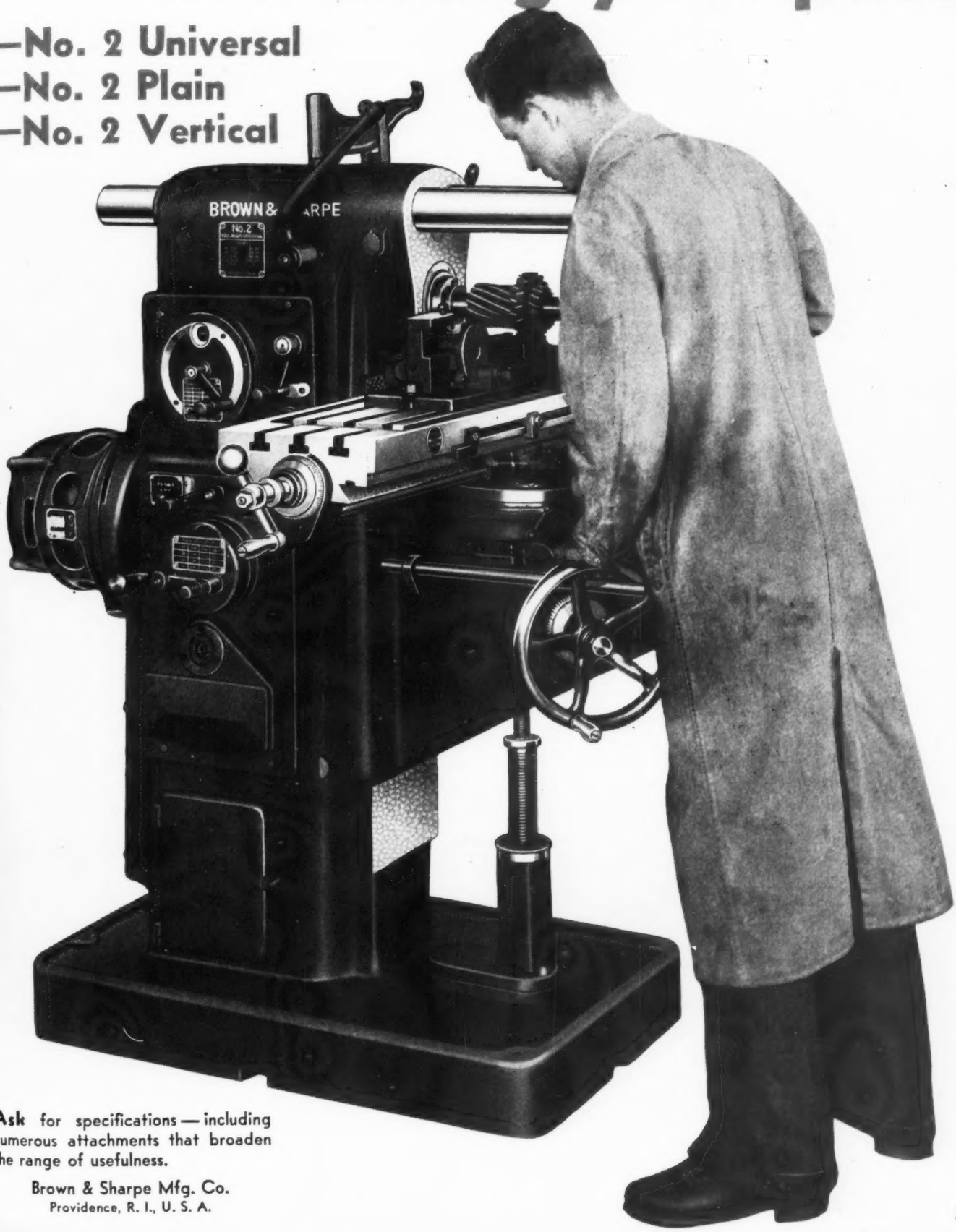


B·S

BROWN &

— —Increasingly Popular

—No. 2 Universal
—No. 2 Plain
—No. 2 Vertical



Ask for specifications — including numerous attachments that broaden the range of usefulness.

Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.

SHARPE

two stories, 70 by 210 feet, is of modern brick and steel construction. It is completely equipped with new machinery for making large as well as small dies and tools. C. B. Geiger is president and general manager.

DETROIT REX PRODUCTS CO., Detroit, Mich., manufacturer of degreasing machines, solvents, and alkali cleaners and strippers, has opened a new branch office at 812 Huron Road, Cleveland, Ohio.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces the opening of a new sales engineering office at 1508 Watervliet Ave., Dayton, Ohio, with R. P. SHARER in charge.

S-P MFG. CO., manufacturer of air-operated chucks, cylinders, collets, and valves, announces its removal to 12415 Euclid Ave., Cleveland, Ohio.

* * *

European Machine Tool Dealer Celebrates Sixtieth Birthday

Hugo Stokvis, president of R. S. Stokvis & Zonen, Rotterdam, Holland, with which company are also affiliated the Stokvis firms in Paris, France, and Brussels, Belgium, celebrated his sixtieth birthday on July 17. On that occasion he was honored by a gathering of friends and associates, among whom were D. de Vries, manager of the Rotterdam firm; A. Goldschmit, manager of the Brussels company; and J. Peskine, manager of the Paris company. The Stokvis firm is over one hundred years old, the machine tool department having been organized thirty-three years ago by Hugo Stokvis, whose efforts are to a large extent responsible for the importance of the Stokvis organization in the machine tool field.

Hugo Stokvis, President R. S. Stokvis & Zonen, European Machinery Dealers

NEW BOOKS AND PUBLICATIONS

HUETTE—TASCHENBUCH DER STOFFKUNDE (Handbook of Materials). 1008 pages, 5 by 7 1/4 inches. Published by the Akademischen Verein Hütte and obtainable from Wilhelm Ernst & Sohn, Köthener Strasse 38, Berlin W. 9, Germany. Price, bound in leather, 20.25 Reichsmarks; cloth, 18 Reichsmarks.

This is the second revised edition of the handbook on materials published under the auspices of the well-known Hütte Society. The book has been edited by Dr. Ing. Georg Sinner with the assistance of a large number of specialists in various branches of industry. The first edition of this work appeared in 1926 and was so well received that it has been deemed advisable to bring out a thoroughly revised and much enlarged edition. The work contains a wealth of information on practically every conceivable material employed in industry, in the building field, and in civil engineering activities. As is the case with all the Hütte handbooks, it is provided with an exceptionally detailed index.

MACHINE DESIGN. By P. H. Hyland and J. B. Kommers. 578 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., 330 W. 42nd St., New York City. Price, $4.50.

This is the second edition of a book written as a text from which to teach the elements of machine design. This edition has been brought out as the result of experience gained in using the book for teaching classes during the last eight years. The book contains fifteen chapters covering the following subjects: General Considerations and Procedure Affecting Design; Metal-Working and Shop Processes; Materials of Construction; Linkwork, Instant Centers, and Velocity Diagrams; Cams; Fundamental Mechanics; Bearings, Friction, and Lubrication; Friction as a Useful Agent; Riveted Joints; Screw Fastenings and Power Screws; Shafting and Shaft Couplings; Keys; Toothed Gears; Design of Various Machine Elements; and Machine Frames.

THE SCIENCE OF VALUATION AND DEPRECIATION. By Edwin B. Kurtz. 221 pages, 6 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, $4.50.

This book, written by the head of the electrical engineering department of the State University of Iowa, offers scientific solutions, based on life experience tables, to basic problems in valuation and depreciation estimating and accounting. The text is divided into eight chapters covering the following phases of the subject: Life experience tables; average life; life expectancy and probable life; remainder service life; annual renewals; composite remainder service life; and replacement insurance.

ARC WELDING MANUAL AND OPERATOR'S TRAINING COURSE. By W. J. Chaffee. 94 pages, 5 1/2 by 8 inches. Published by the Hobart Brothers, Co., Hobart Square, Troy, Ohio. Price, 50 cents.

This is a new revised edition of an arc welding manual originally brought out in 1930. Since that time there have been so many new developments in arc welding methods and equipment that the book has been completely revised and brought up to date. The information is presented in a non-technical manner, so that the book will be as useful to the beginner as to the experienced operator.

LOCATION OF FORD MODEL V-8 POWER PLANT TROUBLES MADE EASY. Arranged by Victor W. Pagé. Chart, 22 by 34 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, 35 cents.

This chart contains instructions that make it easy for owners and operators of Ford V-8 cars to locate the common causes of engine troubles and correct them.

GOOD HOUSEKEEPING AND SAFETY IN FOUNDRIES, AND INDUSTRIAL CODES AND OCCUPATIONAL DISEASE LEGISLATION. Published by the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill., as part of the Proceedings of the forty-first annual convention. Designated as Reprint No. 37-30. Price, $1.50.

AN INVESTIGATION OF RELATIVE STRESSES IN SOLID SPUR GEARS BY THE PHOTO-ELASTIC METHOD. By Paul H. Black. 32 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 288 of the Engineering Experiment Station. Price, 40 cents.

* * *

Information recently received from the Worthington Pump & Machinery Corporation, Harrison, N. J., indicates greatly increased business activity, as compared with last year. The unfilled orders of the corporation on July 1, this year, were over 80 per cent greater than on the same date last year, and were at the highest level in seventeen years. Almost every line of engineering contributed to this increase in orders.